Allen-Bradley

ControlLogix Data Highway Plus/ Remote I/O Communication Interface Module

User Manual

Important User Information

Solid state equipment has operational characteristics differing from those of electromechanical equipment. “Safety Guidelines for the Application, Installation and Maintenance of Solid State Controls” (Publication SGI-1.1) describes some important differences between solid state equipment and hard-wired electromechanical devices. Because of this difference, and also because of the wide variety of uses for solid state equipment, all persons responsible for applying this equipment must satisfy themselves that each intended application of this equipment is acceptable.

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- avoid the hazard
- recognize the consequences

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About This User Manual

What This Preface Contains

This preface describes how to use this manual. The following table describes what this preface contains and its location.

For information about:	See page:
Who Should Use This Manual	P-1
Purpose of This Manual	P-1
Conventions and Related Terms	P-2
Related Products and Documentation	P-4
Rockwell Automation Support	P-4

Who Should Use this Manual

We assume you have a good understanding of the Data Highway Plus protocol and Remote I/O. This user manual contains a brief description of Data Highway Plus in Chapter 2 and a brief description of Remote I/O in Chapter 7.

Purpose of This Manual

This manual describes how to understand, configure and troubleshoot your ControlLogix Data Highway Plus/Remote I/O communication interface module.

For installation information, refer to the ControlLogix Data Highway Plus Communication Interface Module Installation Instructions, publication 1756-5.4.

Conventions and Related Terms

This manual uses the following conventions:

This icon:	Calls attention to:
TIP	helpful, time-saving information
Example	an example
For more information . . .	additional information in the publication referenced

Terms

This term:	Means:
bridge	an internetwork node between two similar communication subnets where protocol translation is minimal
ControlLogix Gateway Configuration tool	software that provides manual configuration capability for the DH+ module
communication module	1756-DHRIO module
connection	a logical communication path
DH+™	Data Highway Plus - A-B's proprietary token pass communications protocol for peer to peer communications
Ethernet®	a physical layer standard using Carrier Sense Multiple Access with Collision Detection (CSMA/CD) methods
Ethernet network	a local area network with a baseband communication rate of 10M bps designed for the high-speed exchange of information between computers and related devices
gateway	a module or set of modules that allows communications between nodes on dissimilar networks
indicator	LED indicator
link	a unique network
module address	a six-bit number used to uniquely identify any module on the local and extended ControlLogix backplane
PCCC	programmable controller communications commands
rack	a physical and logical collection of application modules sharing a common power supply and backplane for module to module communication
RIUP	remove and insert under power
transaction	an exchange of request and data and response and data
transfer	to send a message to the next destination

Related Products and Documentation

The following table lists related ControlLogix products and documentation:

Catalog number:	Document title:	Publication number:
1756-DHRIO	Data Highway Plus Communication Interface Module Installation Instructions	1756-5.4
1756-GTWY	ControlLogix Gateway Configuration Tool Quick Start	1756-10.2

If you need more information on these products, contact your local Allen-Bradley integrator or sales office for assistance. For more information on the documentation, refer to the Allen-Bradley Publication Index, publication SD499.

Rockwell Automation Support

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Local Product Support

Contact your local Rockwell Automation representative for:

- sales and order support
- product technical training
- warranty support
- support service agreements

Technical Product Assistance

If you need to contact Rockwell Automation for technical assistance, please review the troubleshooting information in Appendix A first. If problem persists, then call your local Rockwell Automation representative.

Your Questions or Comments on this Manual

If you find a problem with this manual, please notify us of it on the enclosed Publication Problem Report.

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Specifications **Appendix B**

ControlLogix Data Highway Plus/Remote I/O Communication Interface Module

What This Chapter Contains

This chapter describes the module and what you must know and do before you begin to use it. The following table describes what this chapter contains and its location.

For information about:	See page:
What the Module Does	1-1
Routing Limitations	1-1
Module Features	1-4
Compliance to European Union Directives	1-6
Preventing Electrostatic Discharge	1-7
Removal and Insertion Under Power	1-8
Chapter Summary and What's Next	1-8

What the Module Does

The Data Highway Plus/RIO module supports the following types of communication:

- DH+ Messaging
- Control and Information Protocol (CIP) Messaging
- Remote I/O

You can send messages between devices on Data Highway Plus networks and devices on other networks such as ControlNet, Ethernet, or other DH+.

Using the RIO functionality, a 1756-DHRIO channel in scanner mode transfers discrete and block-transfer data with remote I/O devices. This module allows connection to multiple remote I/O adapters.

Routing Limitations

The 1756-DHRIO module has the capability of routing a message through up to four communications networks and three chassis. This is only a limitation on the routing of a message and not on the total number of networks or chassis in a system.

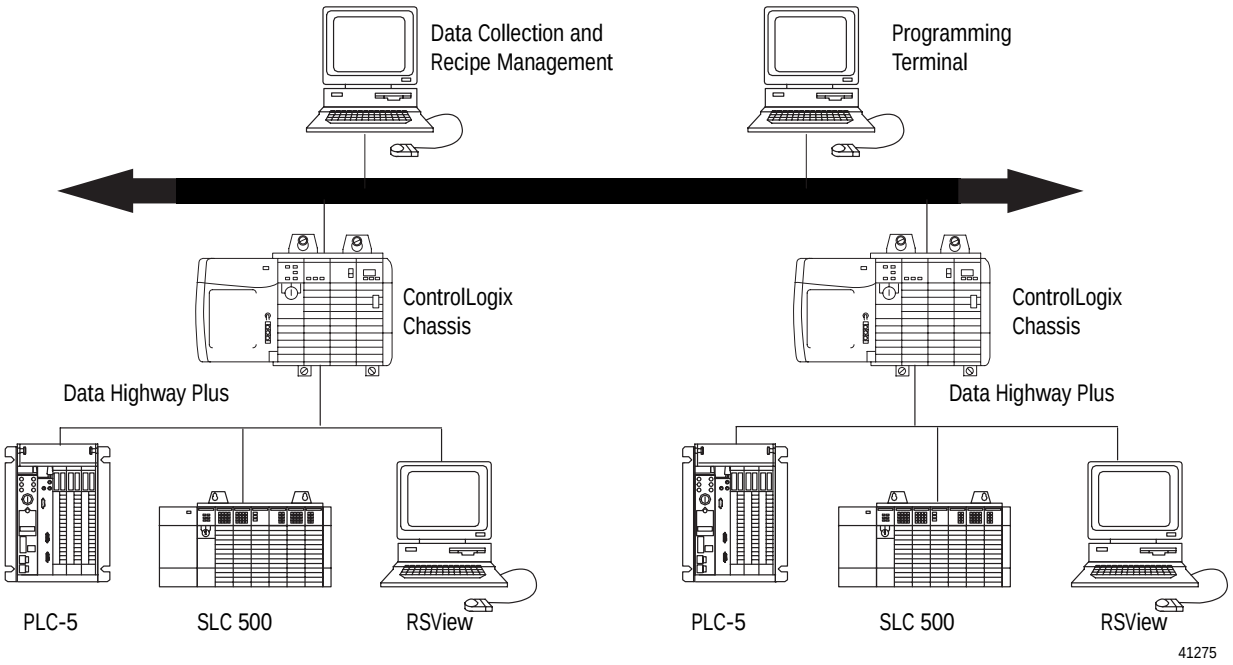
DH+ and CIP Messaging

The 1756-DHRIO module allows an information exchange between devices, such as PLCs, Logix5550 processors in ControlLogix chassis, and SLCs.

With the 1756-DHRIO module, you may exchange information in any of the following scenarios:

- between PLCs/SLCs on different networks
- between the Logix5550 and a PLC/SLC
- between Logix5550s

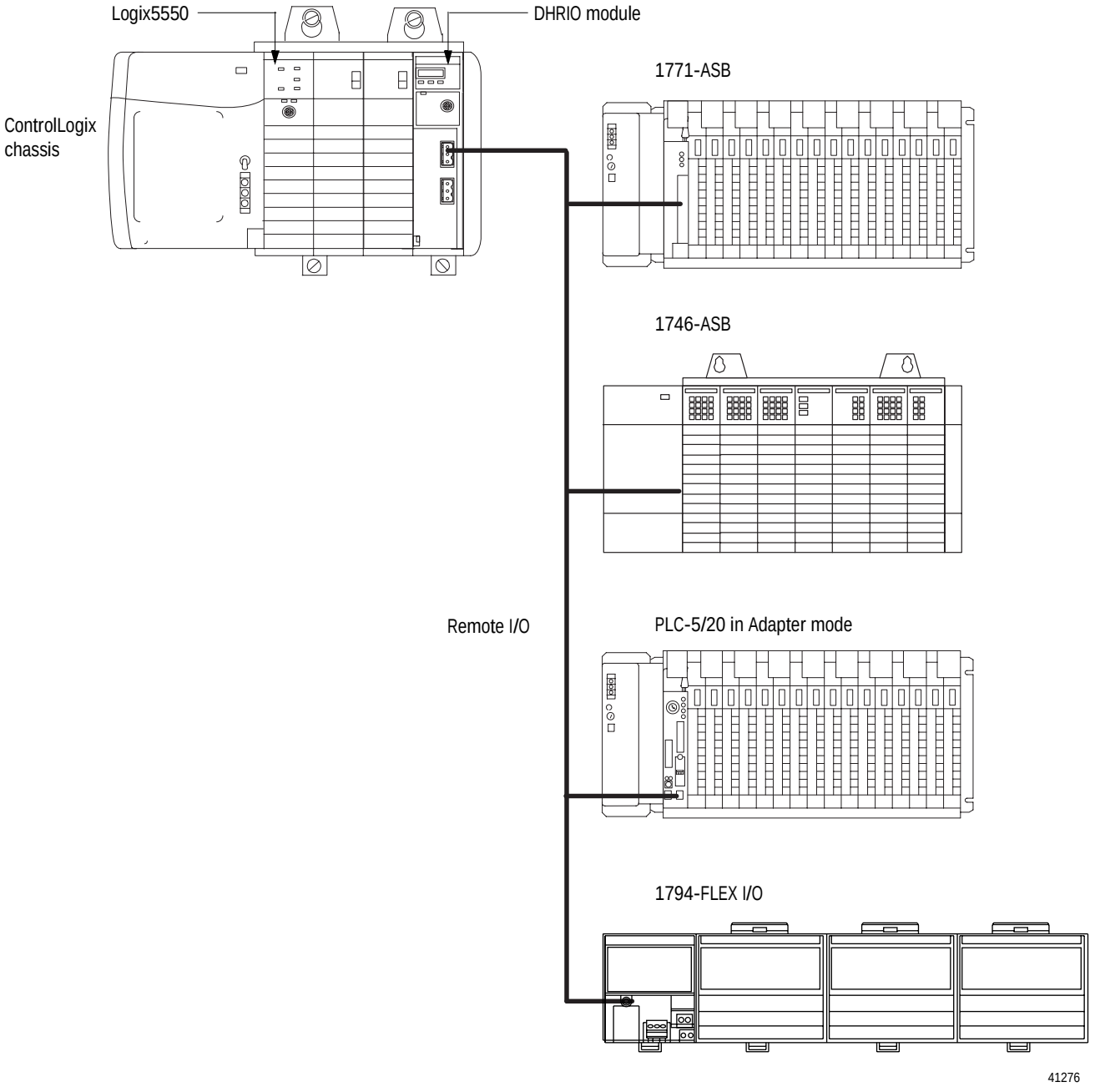
The following illustration shows an example system. Two ControlLogix Gateways link existing Data Highway Plus networks. Communication between PLC-5 programmable controllers on different networks is accomplished in the same manner used for communication within a network.



Remote I/O

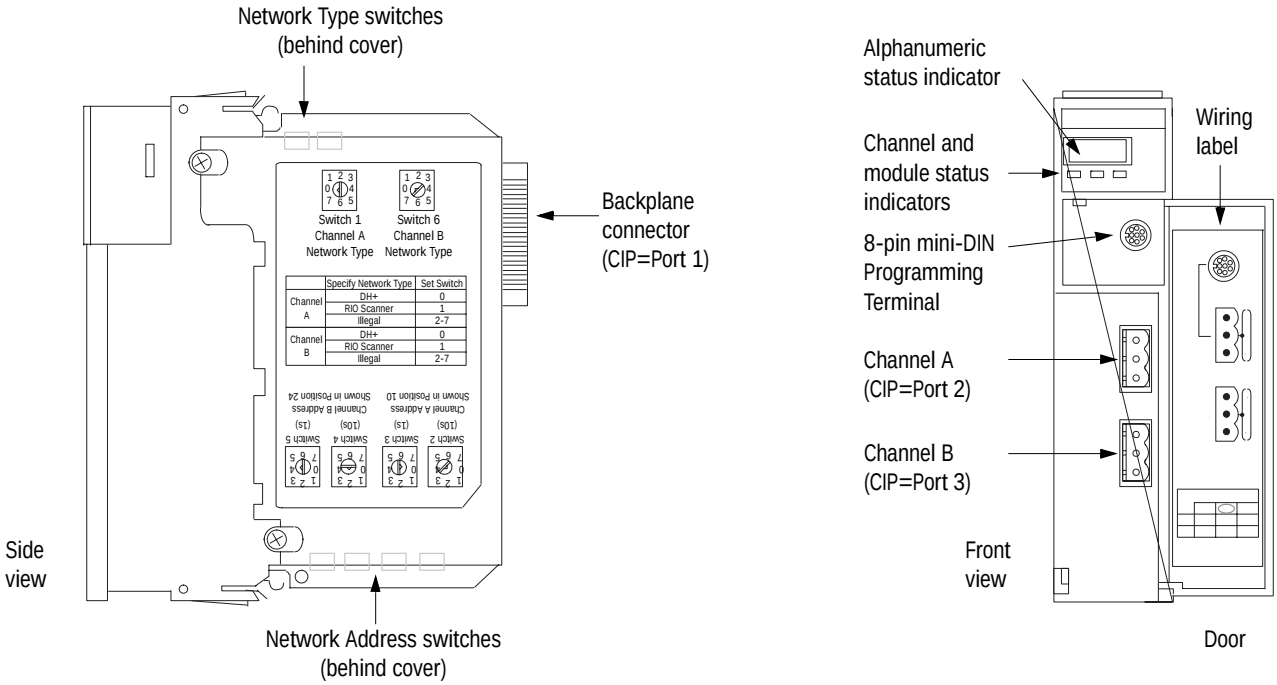
When a channel on the module is configured for Remote I/O, the module will act as a scanner for the RIO network. The Logix5550 controller (1756-L1) communicates to the module's RIO scanner to send and receive the I/O on the RIO network.

The following illustration shows an example system.



Module Features

Use the following illustration to identify the external features of the Data Highway Plus/RIO module.



Other module features are:

- uses routing table that allows DH+ only devices to use the 1756-DHRIO module and ControlLogix chassis to access other networks
- supports routing communications to and from other modules
- has no limit on number of modules per chassis, up to the number of available slots and the capabilities of the power supply
- can be removed and inserted under power without disrupting power to other modules in the chassis

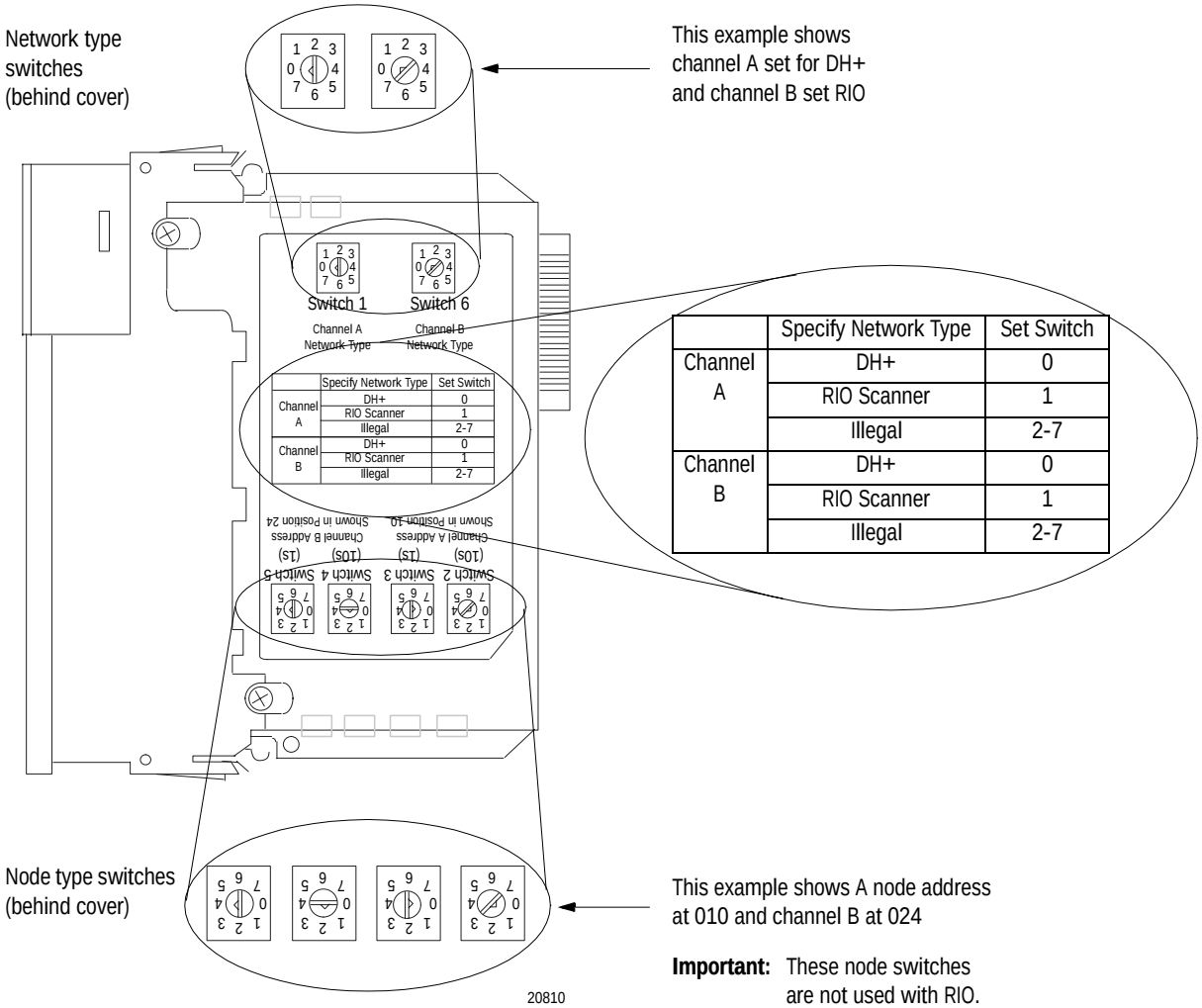
Setting Switches

Before installing the module, you must set the network type switches for DH+ or RIO, depending on your application. For a channel configured as DH+, you must also select a node address within the range of 00-77. Node addresses are set and displayed in octal.

Important: If you require a channel to be configured for DH+, use Channel A. By doing so, you can connect your programming terminal to the connector on the front of the module and communicate to devices on the network.

If only one channel is needed for RIO, use Channel B.

Set the network type and node address switches as shown below.



Alphanumeric Indicators

At module power-up, the alphanumeric indicator illuminates and cycles through a sequence of power-up messages.

Included in the sequence is a scrolling display of the series letter, two digits of the firmware major revision, a dot, and two digits of the firmware minor revision. For example, the display will scroll *B02.14* for a series B module with firmware revision 2.14.

After the power-up sequence, a sequence of information and status messages are displayed on a continuous cycle. The following table shows the sequence of messages for a module that has channel A set for DH+ and channel B set for RIO.

Table 1.1
Data Highway Plus/Remote I/O

Sequence of display:	Where:
A DH	A is the channel (A or B) and DH indicates network type is DH+
A#XX	XX is the channel's node address
XXXX	XXXX is the channel's status message
B IO	B is the channel (A or B) and IO is network type
SCAN	SCAN indicates scanner
XXXX	XXXX is the channel's status message

The module's alphanumeric indicators will stop cycling and display an error message or error code if it detects an error that is severe. See chapter 13 for a detailed list of the error messages and the cyclic status messages that my display across the alphanumeric indicator and for troubleshooting information.

Compliance to European Union Directives

This product has the CE mark and is approved for installation within the European Union and EEA regions. It has been designed and tested to meet the following directives.

EMC Directive

This product is tested to meet Council Directive 89/336/EEC Electromagnetic Compatibility (EMC) and the following standards, in whole or in part, documented in a technical construction file:

- EN 50081-2EMC - Generic Emission Standard, Part 2 - Industrial Environment
- EN 50082-2EMC - Generic Immunity Standard, Part 2 - Industrial Environment

This product is intended for use in an industrial environment.

Low Voltage Directive

This product is tested to meet Council Directive 73/23/EEC Low Voltage, by applying the safety requirements of EN 61131-2 Programmable Controllers, Part 2 - Equipment Requirements and Tests.

For specific information required by EN 61131-2, see the appropriate sections in this publication, as well as the following Allen-Bradley publications:

- Industrial Automation Wiring and Grounding Guidelines For Noise Immunity, publication 1770-4.1
- Guidelines for Handling Lithium Batteries, publication AG-5.4
- Automation Systems Catalog, publication B111

Preventing Electrostatic Discharge

The Data Highway Plus module is sensitive to electrostatic discharge.

ATTENTION: Electrostatic discharge can damage integrated circuits or semiconductors if you touch backplane connector pins. Follow these guidelines when you handle the module:

- Touch a grounded object to discharge static potential
- Wear an approved wrist-strap grounding device
- Do not touch the backplane connector or connector pins
- Do not touch circuit components inside the module
- If available, use a static-safe work station
- When not in use, keep the module in its static-shield bag

Removal and Insertion Under Power

This module is designed to be installed or removed while chassis power is applied.

ATTENTION: When you insert or remove a module while backplane power is on, an electrical arc may occur. An electrical arc can cause personal injury or property damage by:

- sending an erroneous signal to your system's field devices causing unintended machine motion or loss of process control.
- causing an explosion in a hazardous environment.

Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

Chapter Summary and What's Next

In this chapter you learned about:

- what the module does
- module features
- compliance to European Union Directives
- electrostatic discharge
- removal and insertion under power

Move on to Chapter 2 to learn about Using Data Highway Plus.

Basics of Using Data Highway Plus

What This Chapter Contains

This chapter describes the basics of Data Highway Plus. The following table describes what this chapter contains:

For information about using:	See page:
What is Data Highway Plus	2-1
Selecting Devices that You Can Connect	2-1
Link Design	2-2
Programming Terminal Port	2-2
Application Guidelines	2-3
Chapter Summary and What's Next	2-3

What is Data Highway Plus

On the most basic level, Data Highway Plus is a wire or cable and a protocol that connects computers and peripheral devices so that they can communicate. The actual wire used for a network is called the network medium.

A DH+ link transfers data between PLC-5s, SLCs, and other devices that use the DH+ network. These devices are called stations. You can connect a maximum of 32 stations to a single DH+ link.

Selecting Devices that You Can Connect

The following table lists the devices you can connect to a DH+ link.

Table 2.1
Selecting Devices You Can Connect

To:	You can use:	Catalog Number:	Required Cables:
Connect PLC-3 family processors to DH+	Scanner Communication Adapter Module	1775-S5	1770-CD
		1775-SR5	
Connect PLC-5 family processors to DH+	Classic and Enhanced PLC-5 processors using on-board DH+ ports	1785-Series	1770-CD
	ControlNet and EtherNet PLC-5 processors using on-board DH+ ports		
Connect PI systems to DH+	Resource Manager Module	5130-RM1	1770-CD
	Resource Manager Module	5130-RM2	
	Data Highway/Data Highway Plus Communication Interface Module	5130-KA	
Connect IBM XT or AT compatible computers to DH+	Data Highway Plus XT/AT Interface Module	1784-KT	1770-CD
Perform data transmission, management, and local network diagnostics over DH+ network	KTX Communication Interface Card	1784-KTX	1770-CD
Perform data transmission, management, and local network diagnostics over DH+ network	KTXD Communication Interface Card	1784-KTXD	1770-CD
Add memory, storage, and I/O capabilities to computers through DH+	PCMK Communication Card	1784-PCMK	PCM6/B cable assembly
Connect other SLCs to DH+	SLC-5/04 Processor	1747-Series	1770-CD
Connect AutoMax to DH+	AutoMax DH+ Interface	57C-442	1770-CD

Link Design

Use 1770-CD (Belden 9463) cable to connect your module to DH+. Connect a DH+ network using a daisy chain or trunk line/drop line configuration.

Trunk line/drop line considerations:

When using a trunk line/drop line configuration, use 1770-SC station connectors and follow these cable-length guidelines:

- trunk line-cable length—depends on the communication rate of the link
- drop-cable length—30.4 m (100 cable-ft.)

For more information about designing trunk line/drop line configurations, see the Data Highway/Data Highway Plus/Data Highway II/Data Highway-485 Cable Installation Manual, publication 1770-6.2.2.

Verify that your system's design plans specify cable lengths within allowable measurements.

Important: The maximum cable length for DH+ depends on the transmission rate. Configure all devices on a DH+ link to communicate at the same transmission rate.

Also note that the 1756-DHRIO module only supports DH+ communication at the 57.6kbps rate. Be sure to use the correct cable.

For daisy chain configurations, use this table to determine the total cable length you can use.

Table 2.2
Choosing the Correct Cable Length

A DH+ link using this communication rate:	Cannot exceed this cable length:
57.6 kbps	3,048 m (10,000 ft)

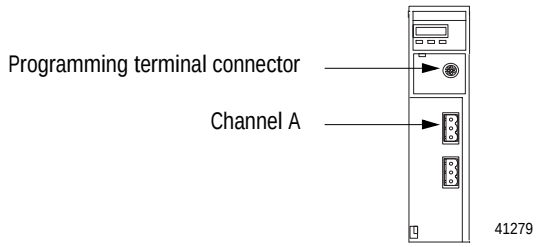
For proper operation, terminate **both** ends of a DH+ link by using the external resistors shipped with the 1756-DHRIO.

Table 2.3
Choosing the Correct Resistor Rating

If your DH+ I/O link operates at:	Use this resistor rating:
57.6 kbps	150Ω

Programming Terminal Port

The programming terminal connector is the same physical link as Channel A. See the diagram below.



Important: When configuring the module switches, remember the programming terminal connector can only be used if Channel A is set for DH+.

Application Guidelines

Consider the following application guidelines when configuring a DH+ link for your system.

- Minimize the number of DH+ nodes to achieve acceptable response times. Keep in mind the size and frequency of messages exchanged between devices.
- Limit the number of stations on your network when you are trying to achieve fastest control response time. Establish separate DH+ networks to bring-on additional stations.
- Do not add or remove stations from the network during machine or process operation. If the network token resides with a device that is removed, the token may be lost to the rest of the network. The network is automatically reestablished, but it could take several seconds. Control would be unreliable or interrupted during this time.
- When possible, do not program processors online during machine or process operation. This could result in long bursts of DH+ activity that could increase response time.
- When possible, add a separate DH+ link for programming processors to keep effects of the programming terminal from the process DH+ link.

Chapter Summary and What's Next

In this chapter, you learned about:

- selecting devices that you can connect
- link design
- application guidelines

Move on to Chapter 3 to learn about DH+ operation.

DH+ Operation

What This Chapter Contains

This chapter describes the operation of Data Highway Plus. The following table describes what this chapter contains:

For information about using:	See page:
Two Methods of Communication Over Data Highway Plus	3-1
Using DH+ Messaging	3-2
Benefits of DH+ Messaging	3-2
Local DH+ Messaging	3-2
Before Programming in a Controller	3-5
Remote DH+ Messaging	3-6
Application Timeout	3-11
Example DH+ Routing Configuration	3-12
Using Control and Information Protocol	3-13
Chapter Summary and What's Next	3-14

Two Methods of Communication Over Data Highway Plus

The 1756-DHRIO module will act as a gateway/bridge for two methods of communication. These methods are:

- DH+ Messaging
- Control and Information Protocol (CIP) Messaging

The following table shows what devices support each method of communication:

Table 3.1
Types of Communication on the 1756-DHRIO module

Type of communication:	Devices supporting this type:
DH+ messaging	PLC-3 PLC-5 PLC-5/250 SLC-500 Logix5550 RSLinx 1.7 Interchange
Control and Information Protocol (CIP) messaging	RSLogix Logix5550

This chapter provides a detailed explanation of each method. The following chapters provide examples of how these methods might be used.

Using DH+ Messaging

Most devices with a DH+ channel support this type of communication. These devices are listed in *Table 2.1 Selecting Devices that You Can Connect* on page 2-1.

DH+ messaging is further divided into two types:

- Local DH+ Messaging
- Remote DH+ Messaging

Before you can design a control system to meet your application needs, be aware of the difference between Local DH+ Messaging and Remote DH+ Messaging.

Benefits of DH+ Messaging

DH+ Messaging provides the following benefits:

- it allows you to send messages between devices on the same link
- it allows you to send messages between devices on different links
- it is compatible with many existing Allen-Bradley modules

Local DH+ Messaging

Devices use local DH+ messaging to communicate between devices on the same physical link.

A device that uses local DH+ messaging must be able to:

- generate local DH+ packets
- support local DH+ protocol
- send and receive messages

A local DH+ message sent on a DH+ network has only enough address information to get the message to a target node on the same DH+ network. This limits the use of local DH+ messaging in a system.

The 1756-DHRIO module has added functionality to allow the use of local DH+ messaging in limited cases.

Receiving Local DH+ Messages on DH+

Because a local DH+ message only has enough address information to get the message to a target node on the same DH+ network, the 1756-DHRIO module that receives this message cannot identify where to send the message to. In this case, the 1756-DHRIO module uses the configuration parameter *Controller Slot*.

The 1756-DHRIO module sends any local DH+ message it receives to the single Controller Slot (default=0) configured for the receiving DH+ channel on the 1756-DHRIO module. You must use the ControlLogix Gateway Configuration Tool (1756-GTWY) to configure the Controller Slot.

There are some messages that, when received by the 1756-DHRIO module, are not sent to the controller slot. In this case, the 1756-DHRIO module generates a response to the message. For a complete listing of these messages, see Appendix A.

Local DH+ messaging **does not** require a populated routing table. Local DH+ messaging **does** require a default (a properly emptied) or an applied (a properly populated and saved) routing table, and a default or applied controller slot for each channel configured for DH+.

Important: Local DH+ Messaging can only target one Logix5550 controller per DH+ channel. Also, the Logix5550 must reside in the same chassis as the 1756-DHRIO module receiving the message.

Sending Local DH+ Messages on DH+

If a 1756-DHRIO channel receives a DH+ message with a destination link ID=0 from a Logix5550 processor in the same chassis, the module will send the message as a local DH+ message.

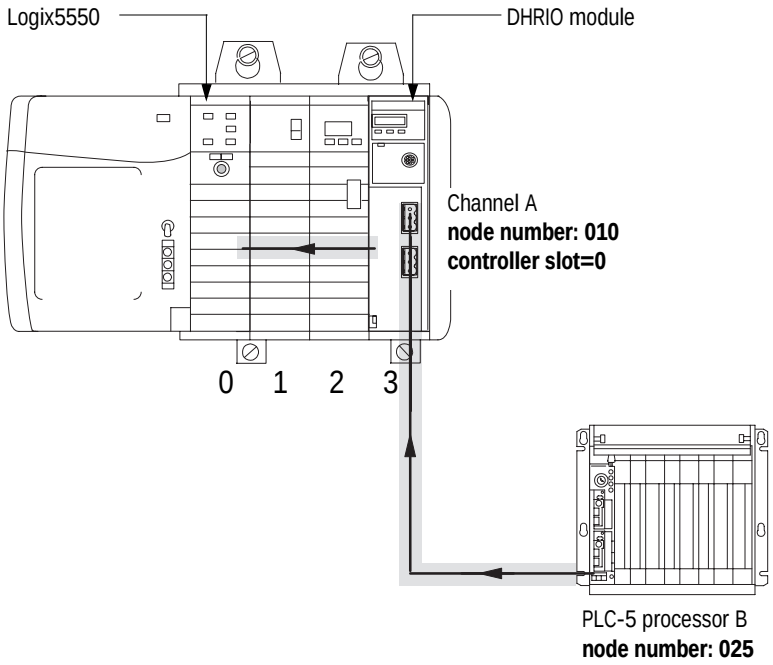
Important: The target of the DH+ message must be on the same DH+ link as the 1756-DHRIO module sending the message. Also, the Logix5550 must reside in the same chassis as the 1756-DHRIO module sending the message on DH+.

Limitations of Local DH+ Messaging

When using Local DH+ Messaging, you must remember the following:

- The DH+ message contains only a node ID for a node on the DH+ network
- A local DH+ message sent to the node ID of a port on the1756-DHRIO module will be forwarded to a single user-configured controller slot
- Messages on one DH+ network cannot be routed to other networks

The following example shows a PLC-5 sending a message to port A on the 1756-DHRIO module. Because the controller slot for port A is configured to “0”, the message is forwarded to the Logix5550 in slot 0.



Routing Error in Local DH+ Messaging

If the 1756-DHRIO has a problem with routing a DH+ message, it may return a response with an error status of D0 hex. A PLC-5 will display this error as D000 hex when monitoring the message instruction. If you receive this error message:

- check your message instruction to make sure a valid destination node was entered
- check your default slot configuration to make sure that it matches the location of the Logix5550 in the chassis
- make sure the 1756-DHRIO module is powered-up

Before Programming in a Controller

Before programming your message block instructions in your PLC-5/SLC, you must:

- determine which links will send and receive DH+ Local messages
- draw a network - make sure you meet the design requirements for Local DH+ messages
- assign DH+ node numbers
- use the ControlLogix Gateway Configuration software to enter the controller slot or execute the default for the controller slot for each channel configured for DH+

Important: These configuration steps must be done for each 1756-DHRIO in the your system.

For more information . . .

For more information on the ControlLogix Gateway Configuration Software, see the ControlLogix Gateway Configuration software user manual, publication 1756-6.5.7.

Remote DH+ Messaging

Devices use remote DH+ messaging to communicate between devices on physically separate networks.

When using remote DH+ messaging, you must include the following in the message instruction:

- destination link ID - a user-configured number representing a network in your system
- remote node or slot - node or slot on the remote network you want to communicate with

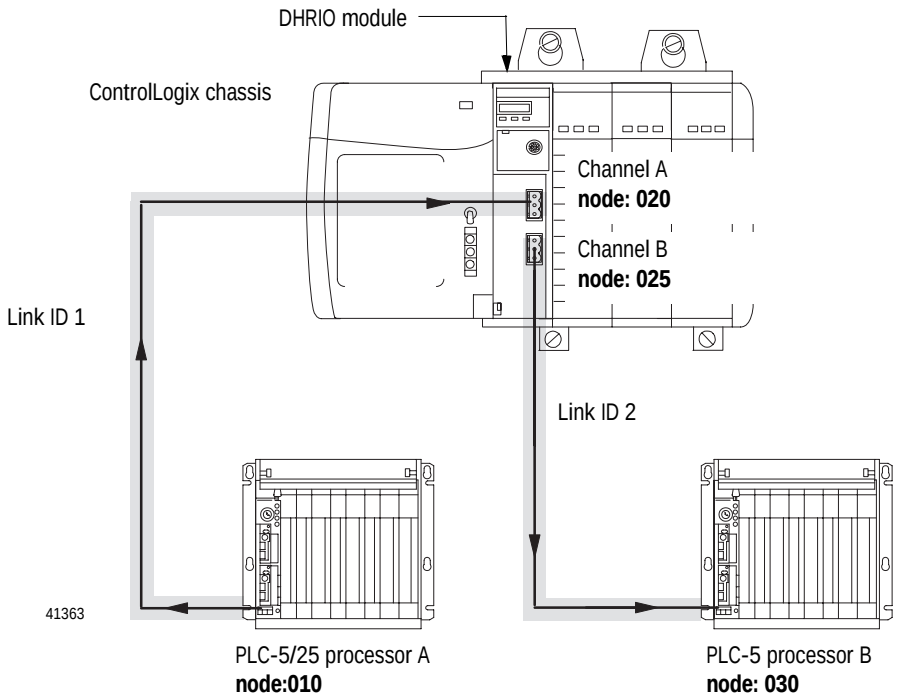
If the message originates on DH+, you must also include:

- local DH+ node - node on your local DH+ network capable of routing the message

If the message originates on Ethernet, ControlNet or ControlLogix, you must also include:

- a CIP path to the first 1756-DHRIO module

The following example of remote DH+ messaging shows a PLC processor A sending a message to PLC processor B:



In the example above, the following information must be included in the remote DH+ message routing message instruction:

- local DH+ node = 020
- destination link ID = 2
- remote DH+ node = 030

A device that uses remote DH+ messaging must be able to:

- generate Remote DH+ packets
- support Remote DH+ protocol
- send and receive messages

Remote DH+ messaging should be used when:

- the message originating device or the message target device is one of the devices listed in *Table 2.1 Selecting Devices that You Can Connect* on page 2-1
- there is a DH+ link in the message's path from originator to target
- the message originating device and the message target device are on separate networks or the message target is in a ControlLogix chassis and there is more than one Logix5550 target in the chassis

To use remote DH+ messaging, each network that is an originating network or target network must have a unique link ID. The 1756-DHRIO module requires these link IDs to be decimal values between 1-199. Each DH+ channel on a 1756-DHRIO must have its own unique link ID.

A source network is the network the message originates on. The destination network is the network the message is targeted for. This applies to all source and destination networks, whether they are DH+, ControlNet, Ethernet or a ControlLogix chassis.

Important: For remote DH+ messaging, the ControlLogix chassis should be considered a separate, independent network. Therefore, a system of 1 DH+ network and one ControlLogix chassis is a two link system.

The ControlLogix chassis is **required** to be a separate, independent link for DH+ messaging if there is more than one message target Logix5550 controller in a ControlLogix chassis.

The 1756-DHRIO module contains a routing table that you define for your application. You must use the ControlLogix Gateway Configuration Tool (1756-GTWY) to configure your routing table.

For more information . . .

For more information on the ControlLogix Gateway Configuration Software, see the ControlLogix Gateway Configuration software user manual, publication 1756-6.5.7.

By using the routing table, the 1756-DHRIO allows existing devices, such as PLC-5s, to use ‘DH+ Remote Addressing’ for messaging. The routing table used in your 1756-DHRIO module contains information used to steer Remote DH+ Messages through the system to ‘remote’ nodes located on separate networks.

Before programming your message block instructions in your controller, you must:

- determine which links will send and receive remote DH+ messaging
- draw a network - make sure you meet the design requirements for remote DH+ messaging

If you are using remote DH+ messaging, you must also:

- assign link numbers - numbers must be a decimal value between 1-199. ControlLogix chassis may also be assigned link IDs. Remember that the programming terminal and channel A are the same physical link
- assign DH+ node numbers
- use the ControlLogix Gateway Configuration software to enter routing tables into each 1756-DHRIO module.

Limitations of Remote DH+ Messaging

Remote DH+ Messages are actually encapsulated in Control and Information Protocol (CIP) messages and sent on Control and Information Protocol connections when they are sent across ControlNet, Ethernet, and the ControlLogix chassis. Although this is transparent to the user, there are resource limits associated with Control and Information Protocol on the 1756-DHRIO.

The 1756-DHRIO will support 32 CIP connections per DH+ channel. These connections are made when devices want to send a DH+ message out of a 1756-DHRIO's DH+ channel and are made by the 1756-DHRIO when it receives DH+ message traffic. The 1756-DHRIO will recover connections if they are not being used.

Because of the various paths involved, the 1756-DHRIO will respond to 'out of connections' in one of the following ways:

- The 1756-DHRIO may generate a Routing Error (see page 4-9) on DH+ for DH+ message requests if there are no connections available.
- The Message Originator may generate an Application Timeout (see page 3-11) if a remote 1756-DHRIO has no connections available for a DH+ Message response.
- The Message Originator may receive an 'out of connections' error if the path from the Originator to the 1756-DHRIO is ControlLogix chassis, ControlNet or Ethernet.

Routing Errors in Remote DH+ Messaging

If the 1756-DHRIO has a problem with routing a Remote DH+ Message, it may return a response with an error status of D0 hex. A PLC-5 will display this error as D000 hex when monitoring the message instruction. If you receive this error message:

- check your message instruction to make sure a valid gateway node, link ID and destination node were entered
- check your routing table in each DH+ module that the message passes through
- make sure all 1756-DHRIO modules are connected and powered-up

Configuration Information in DH+ Messaging

When you are using DH+ messaging, you must use either default configuration or write specific configuration for your application.

The following configuration information is stored in the non-volatile memory on your 1756-DHRIO module when you apply configuration using the Gateway Configuration Tool (1756-GTWY):

- Any routing table that may be needed to send DH+ messages through the module - must be applied to the module's configuration separately from other information
- Controller slot for each DH+ channel - must be applied to the module's configuration separately from other information
- Slot number of the module
- Chassis serial number

Important: If you restore default defaults using the Gateway Configuration Tool (1756-GTWY), the slot number and chassis serial number are stored in the 1756-DHRIO module's non-volatile memory but no routing table is used and the controller slot for both DH+ channels is set to 0.

Generating Configuration Faults

When you insert a 1756-DHRIO module in a ControlLogix chassis, the configuration information stored in the module's non-volatile memory is compared to the slot and serial number of the chassis it is entering. If any information does not match, the 1756-DHRIO module will generate a configuration fault.

For a complete listing of the configuration faults that may be displayed on your 1756-DHRIO module, see chapter 13.

Application Timeout

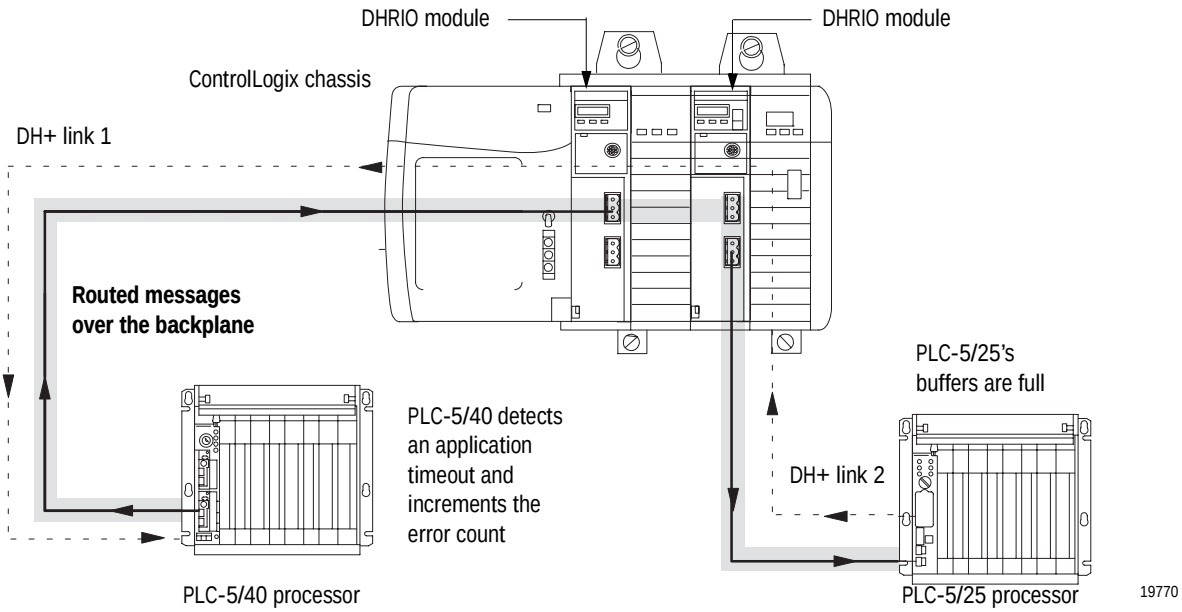
When an error occurs while sending a message to a remote link, it will appear to the sending station as an application timeout because error messages are not routed back. When an error occurs during routing, it may be dropped.

For example, if a PLC 5/40 processor sends a message to a PLC processor, and the PLC-5/25 processor's buffers are full, three things happen:

- the PLC-5/25 processor refuses the message because the buffers are full
- when no reply is received, the originator detects an application timeout
- the originator increments its error count

The PLC-5/40 processor can retry to send the message later.

Example of an Application Timeout

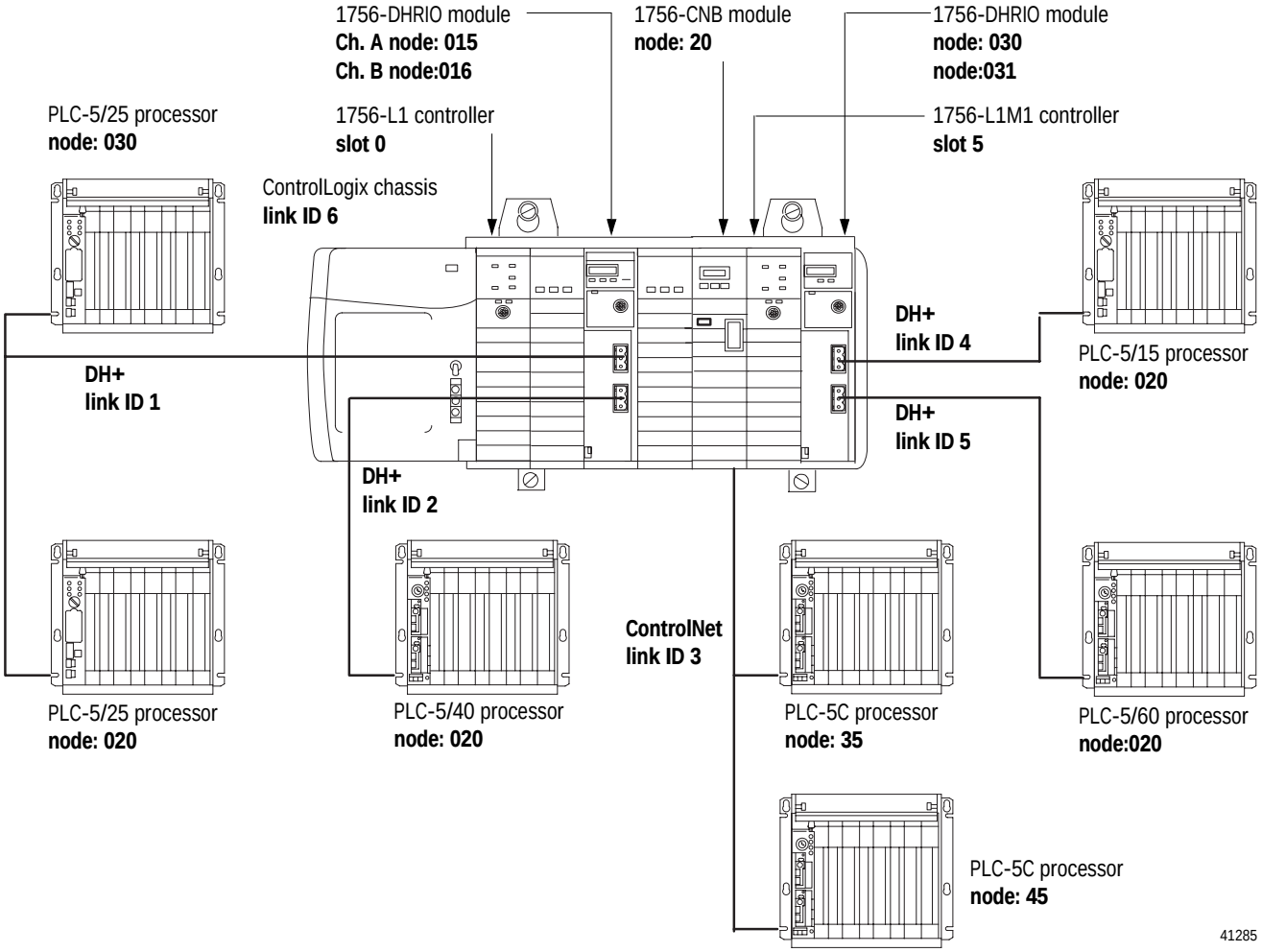


Example DH+ Routing Configuration

The figure below shows an example DH+ routing configuration.

Node numbers on DH+ are given in octal. Node numbers on ControlNet and slot numbers in ControlLogix chassis are given in decimal. Links IDs for all networks are given in decimal.

Important: Some devices in the figure have the same node number because they are on different networks. Devices on the same network must have unique node numbers. You must assign the node numbers.



Using Control and Information Protocol (CIP) Messaging

Control and Information Protocol (CIP) is the new protocol that serves as the communications mechanism on ControlLogix chassis, ControlNet network and Ethernet with the EPIC protocol.

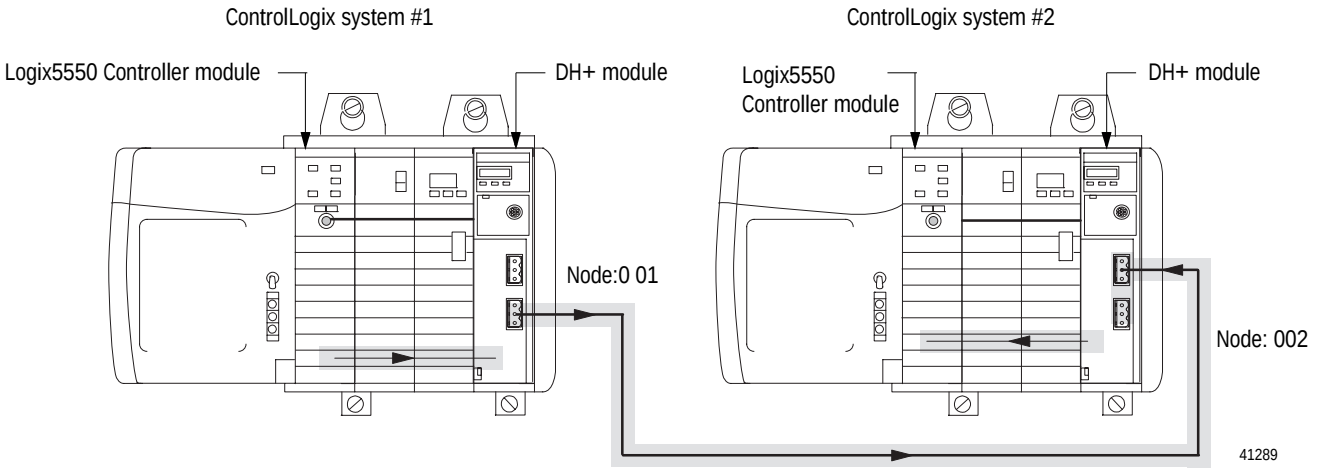
Like DH+ messaging, CIP supports communication between devices on the same link and physically separate links. However, CIP Messaging uses a different method to route messages than DH+ Messaging.

CIP uses a 'relative path' concept for routing messaging. Because the message itself, or the connection the message is sent on, contains all the information required to route the message, CIP messages do not require any routing table or link IDs. For more information on paths, see Chapter 4.

Devices such as ControlLogix devices, devices that use the ControlNet network, and devices that use EPIC protocol on Ethernet support this new type of communication.

Important: Your 1756-DHRIO module supports bridging CIP messaging over a DH+ link. Your 1756-DHRIO module does not support bridging CIP I/O data from a Logix5550 controller to an 1756-I/O module.

The message originator, target, and all modules and links between them must support CIP to send a message using CIP protocol.



Limitations of CIP Messaging

The 1756-DHRIO module will support bridging a total of 5 CIP connections. These 5 count against the 32 connections per DH+ channel. So if a 1756-DHRIO module has used 30 connections for DH+ Message Routing, it can only use 2 connections to bridge a CIP message through the module.

Chapter Summary and What's Next

In this chapter, you learned about:

- methods of communication
- local DH+ message routing
- remote DH+ message routing
- CIP message routing

Move on to Chapter 4 to learn about programming terminal operation over DH+.

Programming Terminal Operation Over DH+

What This Chapter Contains

This chapter describes how to connect your programming terminal over DH+. The following table describes what this chapter contains:

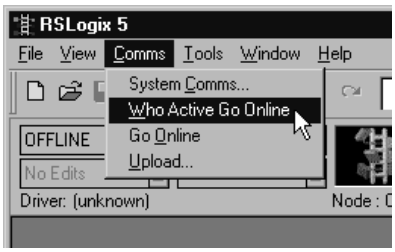
For information about using:	See page:
Connecting Your Programming Terminal Over DH+ Using RSLogix 5	4-1
Connecting Your Programming Terminal Over DH+ Using RSLogix 500	4-2
Connecting Your Programming Terminal Over DH+ Using RSLogix 5000	4-3
Defining Connection Paths	4-5
Chapter Summary and What's Next	4-9

You must use programming software specific to your application to connect your programming terminal on the 1756-DHRIO module over DH+.

Connecting Your Programming Terminal Over DH+ Using RSLogix 5

For applications connecting RSLogix 5 to a PLC-5:

1. Start the RSLogix 5 software.
2. From the Comms menu, select Who Active Go Online, as shown below:



This selection starts the Who application in RSLinx, which lets you use RSLinx to view modules in the selected ControlLogix system.

3. To navigate through the control system, including over DH+, select the module and double-click on it.

For a detailed instructions on using the Who applications, refer to the RSLinx User Guide, publication 9399-WAB32LUG, or the RSLinx online help.

For more information . . .

Connecting Your Programming Terminal Over DH+ RSLogix 500

For applications connecting RLogix 500 to a SLC-5/04, you must:

1. Start the RSLogix 500 software.
2. From the Comms menu, select Who Active Go Online, as shown below:

This selection starts the Who application in RSLinx, which lets you use RSLinx to view modules in the selected ControlLogix system.

3. To navigate through the control system, including over DH+, select the module and double-click on it.

For a detailed instructions on using the Who applications, refer to the RSLinx User Guide, publication 9399-WAB32LUG, or the RSLinx online help.

For more information . . .

Connecting Your Programming Terminal Over DH+ Using RSLogix 5000

For applications connecting RSLogix 5000 to a Logix5550, you must configure the appropriate communication driver for the network that links the workstation using RSLogix 5000 and the Logix5550.

The communication driver enables the controller to communicate over the network. You must configure communication drivers in RSLinx software and then select the appropriate driver in the programming software.

To configure the available communication drivers for the Logix5550 controller through the programming software:

1. Start the RSLogix 5000 software.
2. From the Communications menu, select Configure, as shown below.

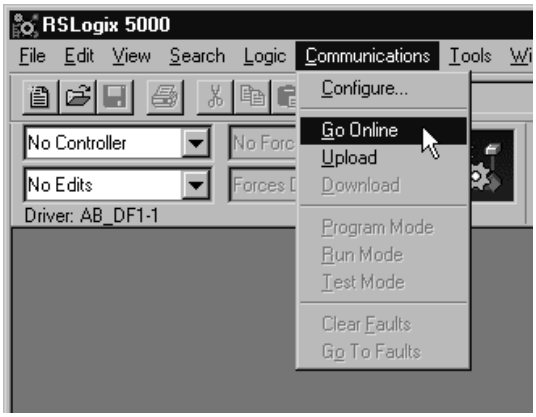
3. Select the Communications tab on the Workstation options screen and fill in the following information.

In this field:	Enter:
Driver	This is a display-only field that describes the communications protocol of the selected driver. Use the drop-down menu to select the driver: • ControlNet (AB_KTC) • DF1 (AB_DF1) • DH+ (AB_KT) • Ethernet (TCP)
Path	This is the connection path to the controller you wish to communicate with from the communications card you are connected to. The path consists of a sequence of decimal numbers separated by commas. The field displays up to three lines for a long path, and a scroll-bar appears if the entire field cannot be displayed.
Recent	This button navigates to the Recent Configurations dialog where you can choose from the recent configurations stored on the workstation.

Any driver configured through the programming software must first have been configured using RSLinx software.

After configuring your communication driver, you must:

4. Select the Communications menu and select Go Online, as shown below:



This selection starts the Who application in RSLinx, which lets you use RSLinx to view modules in the selected ControlLogix system.

5. To navigate through the control system, including over DH+, select the module and double-click on it.

For more information . . .

For a detailed instructions on using the Who applications, refer to the RSLinx User Guide, publication 9399-WAB32LUG, or the RSLinx online help.

Defining Connection Paths

You may have to configure a connection path when configuring controller to controller communication or when configuring communication from a workstation to a controller. The connection path starts with the controller or the communications card in the workstation.

The following steps construct a communication path:

1. Separate the number or address entered in each step with a comma. All numbers are in decimal by default. You can enter any number, other than an Ethernet IP address, in another base by using the IEC-1131 prefix (8# for octal, 16# for hexadecimal). Ethernet IP addresses are always decimal numbers separated by periods.
2. To construct the path, you enter one or more *path segments* that lead to the controller. Each path segment takes you from one module to another module over the ControlBus backplane or over a DH+, ControlNet, or Ethernet networks.

   You can only have 8 paths lead to the controller.

Each *path segment* contains two numbers:

x,*y*

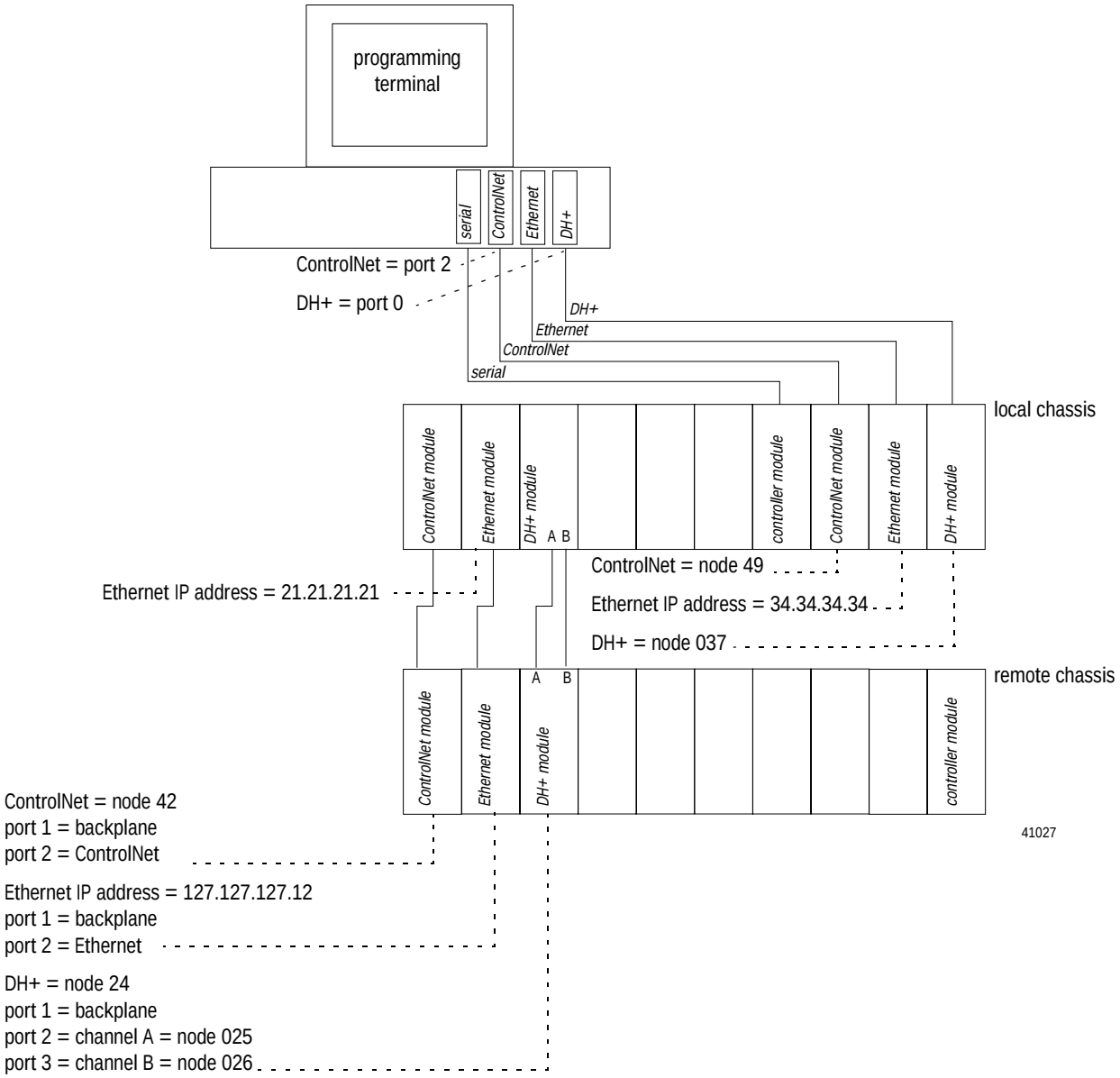
Where:

This	Is:	
x	number of the type of port you use to exit from the module you are at:	
	0 DH+ port from a KT card	
	1 backplane from any 1756 module	
	2 RS232 port from a 1756-L1 controller	
	2 ControlNet port from a KTC card or a 1756-CNB module	
	2 Ethernet port from a 1756-ENET module	
	2 DH+ port over channel A from a 1756-DHRIO module	
	3 DH+ port over channel B from a 1756-DHRIO module	
,	separates the first number and second number of the path segment	
y	address of the module you are going to	
	For	**Address means:**
	ControlBus backplane	slot number (0-16 decimal)
	DF1 network	station address (0-254)
	ControlNet network	node number (1-99 decimal)
	DH+ network	node number (0-77 octal)
	Ethernet network	IP address (four decimal numbers separated by periods)

If you have multiple path segments, you must also separate each path segment with a comma (,).

Connection path examples

The following examples are based on this system:



Network:	Example:	Description:
serial	Programming terminal to controller module in logical rack. Use DF1 Upload logic from local controller. (controller is directly connected to the programming terminal)	Configure DF1 driver. Leave connection path blank.
	Programming terminal to controller module in remote rack. Use DF1 (connected to controller in local rack) Use ControlNet to bridge to remote chassis	Configure the DF1 driver. Enter connection path: 1,0,2,42,1,9 1 = backplane port of the Logix5550 controller in slot 6 of the local chassis 0 = slot number of the 1756-CNB module in the local chassis 2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis 42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis 1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis 9 = slot number of the controller in the remote chassis
ControlNet	Programming terminal to controller module in remote chassis. Use ControlNet throughout the system.	Configure the ControlNet driver. Enter connection path: 2, 49, 1, 0, 2, 42, 1, 9 2 = ControlNet port of the KTC communications card in the workstation 49 = ControlNet node of the 1756-CNB module in slot 7 of the local chassis 1 = backplane port of the 1756-CNB module in slot 7 of the local chassis 0 = slot number of the 1756-CNB module in the local chassis 2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis 42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis 1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis 9 = slot number of the controller in the remote chassis
Ethernet	Programming terminal to controller module in remote rack. **IMPORTANT**: Connection path does not include path segment from Ethernet card in programming terminal to Ethernet module in local chassis because Ethernet driver is configured for the Ethernet module already in the local chassis Bridge across Ethernet	Configure the Ethernet driver. Enter connection path: 1, 1, 2, 127.127.127.12, 1, 9 1 = backplane port of the 1756-ENET module in slot 8 of the local chassis 1 = slot number of the other 1756-ENET module in the local chassis 2 = Ethernet port of the 1756-ENET module in slot 1 of the local chassis 127.127.127.12 = IP address of the 1756-ENET module in the remote chassis 1 = backplane port of the 1756-ENET module in slot 1 of the remote chassis 9 = slot number of the controller in the remote chassis

Network:	Example:	Description:
DH+	Program the controller in slot 9 of the remote chassis. Go from DH+ to the local chassis. Bridge to the remote chassis over ControlNet.	Configure the DH+ driver. Enter connection path: 0, 8#37, 1, 0, 2, 42, 1, 9 0 = DH+ port of the KT communications card in the workstation 8#37 = octal DH+ node of the 1756-DHRIO module in slot 9 of the local chassis 1 = backplane port of the 1756-DHRIO module in slot 9 of the local chassis 0 = slot number of the 1756-CNB module in the local chassis 2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis 42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis 1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis 9 = slot number of the controller in the remote chassis
	Program the controller in slot 9 of the remote chassis. Go from DH+ to the local chassis. Bridge across DH+ to the remote controller.	Configure the DH+ driver. Enter connection path: 0, 8#37, 1, 2, 3, 8#24, 1, 9 0 = DH+ port of the KT communications card in the workstation 8#37 = octal DH+ node of the 1756-DHRIO module in slot 9 of the local chassis 1 = backplane port of the 1756-DHRIO module in slot 9 of the local chassis 2 = slot number of the other 1756-DHRIO module in the local chassis 3 = Channel B of the 1756-DHRIO module in slot 2 of the local chassis, configured for DH+ 8#24 = DH+ node of the 1756-DHRIO module in slot 2 of the remote chassis 1 = backplane port of the 1756-DHRIO module in slot 2 of the remote chassis 9 = slot number of the controller in the remote chassis
ControlNet Ethernet DH+	Use several network connections across different network bridges: • DF1 (connected to controller module in local rack) • ControlNet to the remote chassis • Ethernet back to the local chassis • DH+ back to the remote chassis	Configure the DF1 driver (to handle worst case performance) Enter connection path: 1, 0, 2, 42, 1, 1, 2, 21.21.21.21, 1, 2, 2, 8#25, 1, 9 1 = backplane port of the Logix5550 controller in slot 6 of the local chassis 0 = slot number of the 1756-CNB module in the local chassis 2 = ControlNet port of the 1756-CNB module in slot 0 of the local chassis 42 = ControlNet node of the 1756-CNB module in slot 0 of the remote chassis 1 = backplane port of the 1756-CNB module in slot 0 of the remote chassis 1 = slot number of the 1756-ENET module in the remote chassis 2 = Ethernet port of the 1756-ENET module in slot 1 of the remote chassis 21.21.21.21 = IP address of the 1756-ENET module in slot 1 of the local chassis 1 = backplane port of the 1756-ENET module in slot 1 of the local chassis 2 = slot number of the 1756-DHRIO module in the local chassis 2 = Channel A of the 1756-DHRIO module in slot 2 of the local chassis, configured for DH+ 8#25 = DH+ node of the 1756-DHRIO module in slot 2 of the remote chassis 1 = backplane port of the 1756DHRIO in slot 2 of the remote chassis 9 = slot number of the controller in the remote chassis

Chapter Summary and What's Next

In this chapter, you learned about programming terminal operation over DH+.

Move on to Chapter 5 to see examples of PLC to PLC Messaging.

PLC-5 or SLC-5/04 to PLC-5 or SLC-5/04 Messaging

What This Chapter Contains

This chapter describes how to use DH+ messaging between PLC-5s and between SLC-5/04s. The following table describes what this chapter contains and its location:

For information about using:	See page:
DH+ Messaging Between PLC-5s With One 1756-DHRIO Module	5-2
DH+ Messaging Between SLC-5/04s with Two 1756-DHRIO Modules with One ControlLogix Chassis	5-5
DH+ Messaging Between PLC-5s with Multiple ControlLogix Chassis	5-9
DH+ Messaging From PLC-5 to PLC-5C on ControlNet	5-13
Chapter Summary and What's Next	5-16

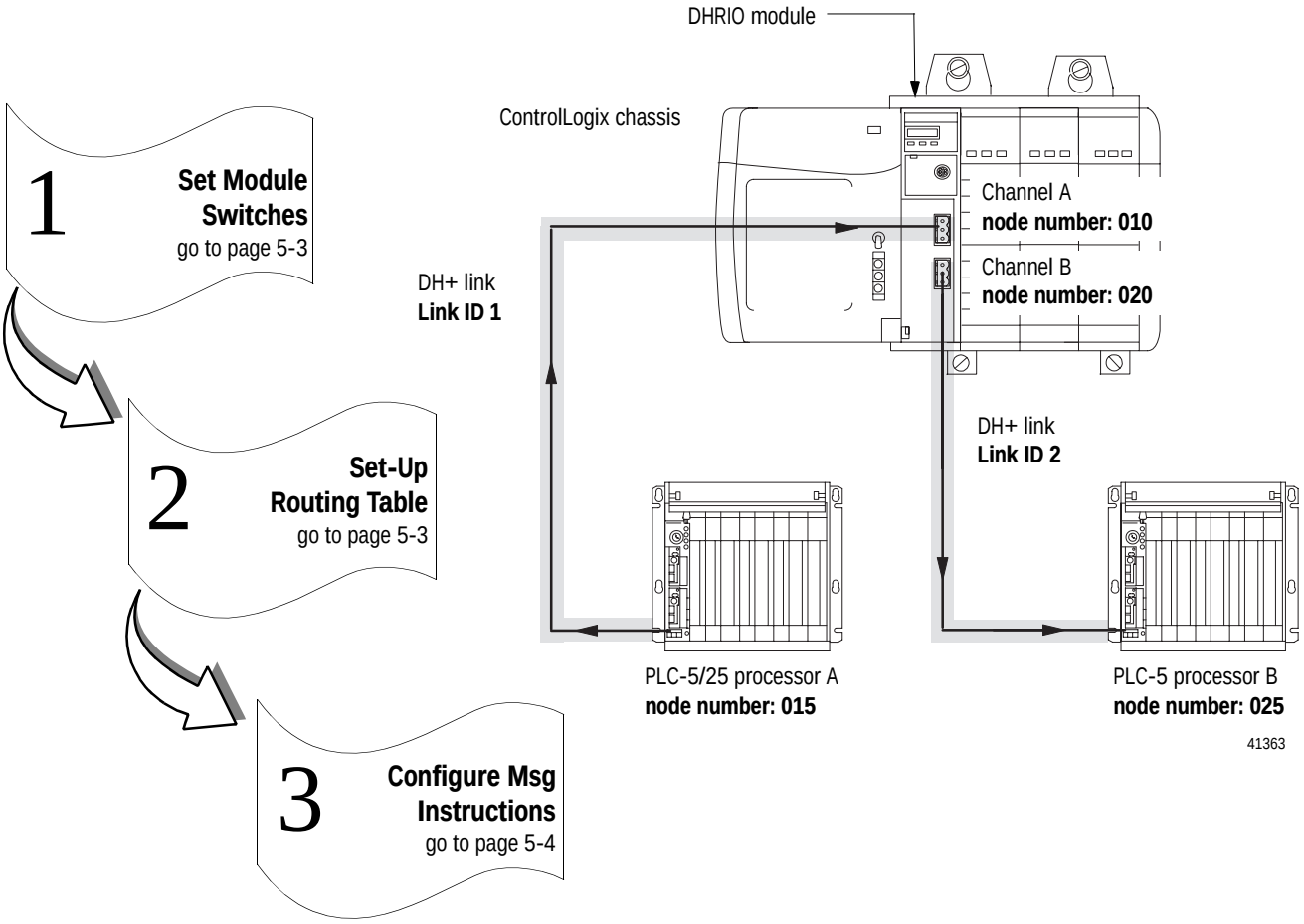
This chapter contains four example applications using DH+ messaging between programmable controllers. Each example explains what steps must be taken to perform these operations.

Important: The examples use PLC-5s and SLC-5/04s to send DH+ messages. In each case, the use of these devices is strictly for example purposes and not an indication of restrictions on the 1756-DHRIO module. Examples using PLC-5s could, in fact, use SLC-5/04s and examples using SLC-5/04s could use PLC-5s.

DH+ Messaging Between PLC-5s With One 1756-DHRIO Module

This application sends a DH+ message from PLC-5 processor A through a 1756-DHRIO module to PLC-5 processor B. Remote DH+ messaging is required to send the message.

The following diagram illustrates the steps you follow to use such an application:

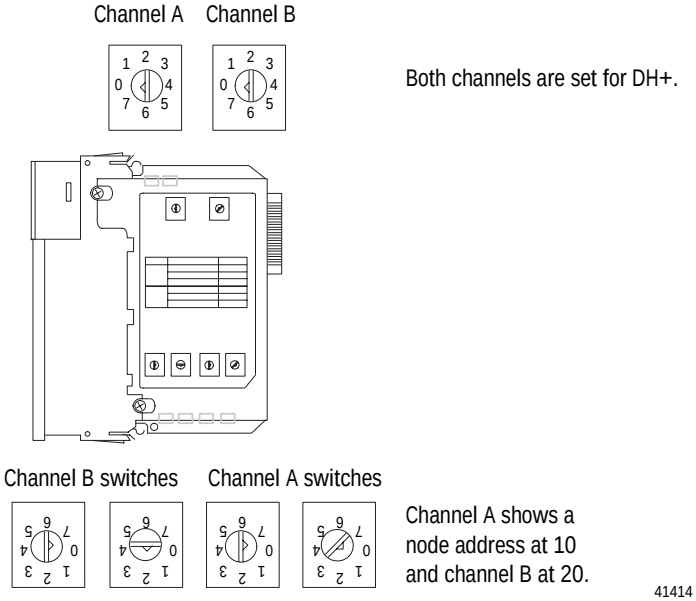


1 **Set Module Switches**

See setting switches 1-5

Set the Module Switches

In this application, both Channel A and Channel B on the 1756-DHRIO module must be set for DH+. Set the switches as shown below.

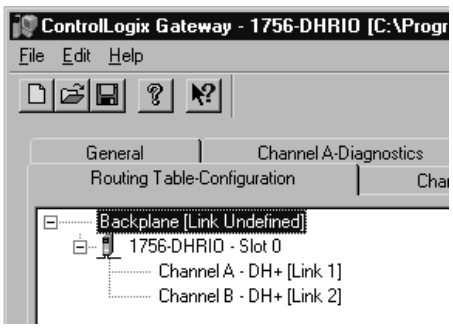


2 **Set -Up Routing Table**

See remote DH+ messaging 3-6

Set-Up a Routing Table for the 1756-DHRIO Module

1. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the 1756-DHRIO module. Your table should look like this:



2. Apply the routing table to your application.

Important: Controller slot values for channels configured for DH+ should be applied or restored to default value, using the appropriate software tabs.

In this example, controller values do not matter, but failure to enter a value, specific or default, will generate a configuration fault for that channel.

For more information on how to set-up a routing table using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

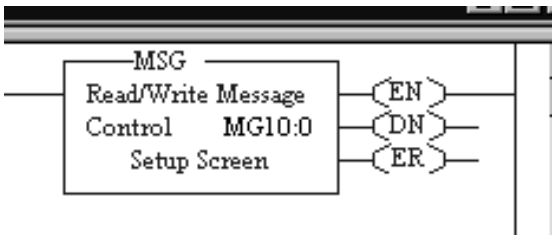
3 **Configure Msg Instructions**

See PLC-5 Instruction set reference, publication 1785-6.1

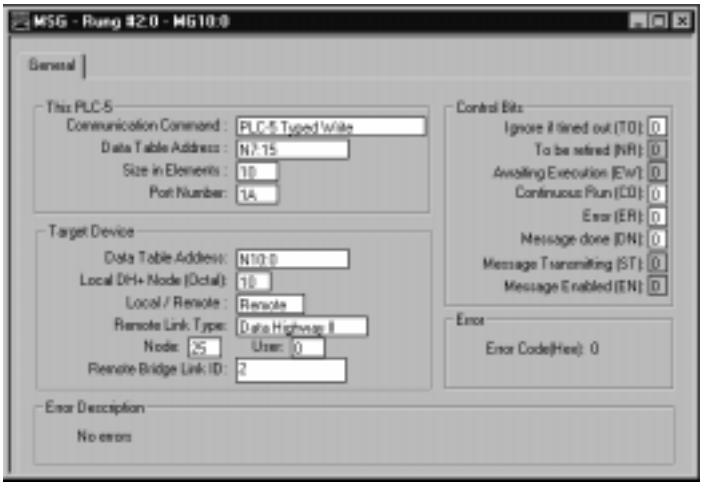
Configure Message Instructions

You must use RSLogix5 to configure the PLC-5 message instructions. Your message instructions should look like this:

Ladder rung



Setup screen



Important: When choosing a *Remote Link Type* in RSLogix 5, you can choose either *Data Highway* or *Data Highway II*. The *User* field only appears in Data Highway II.

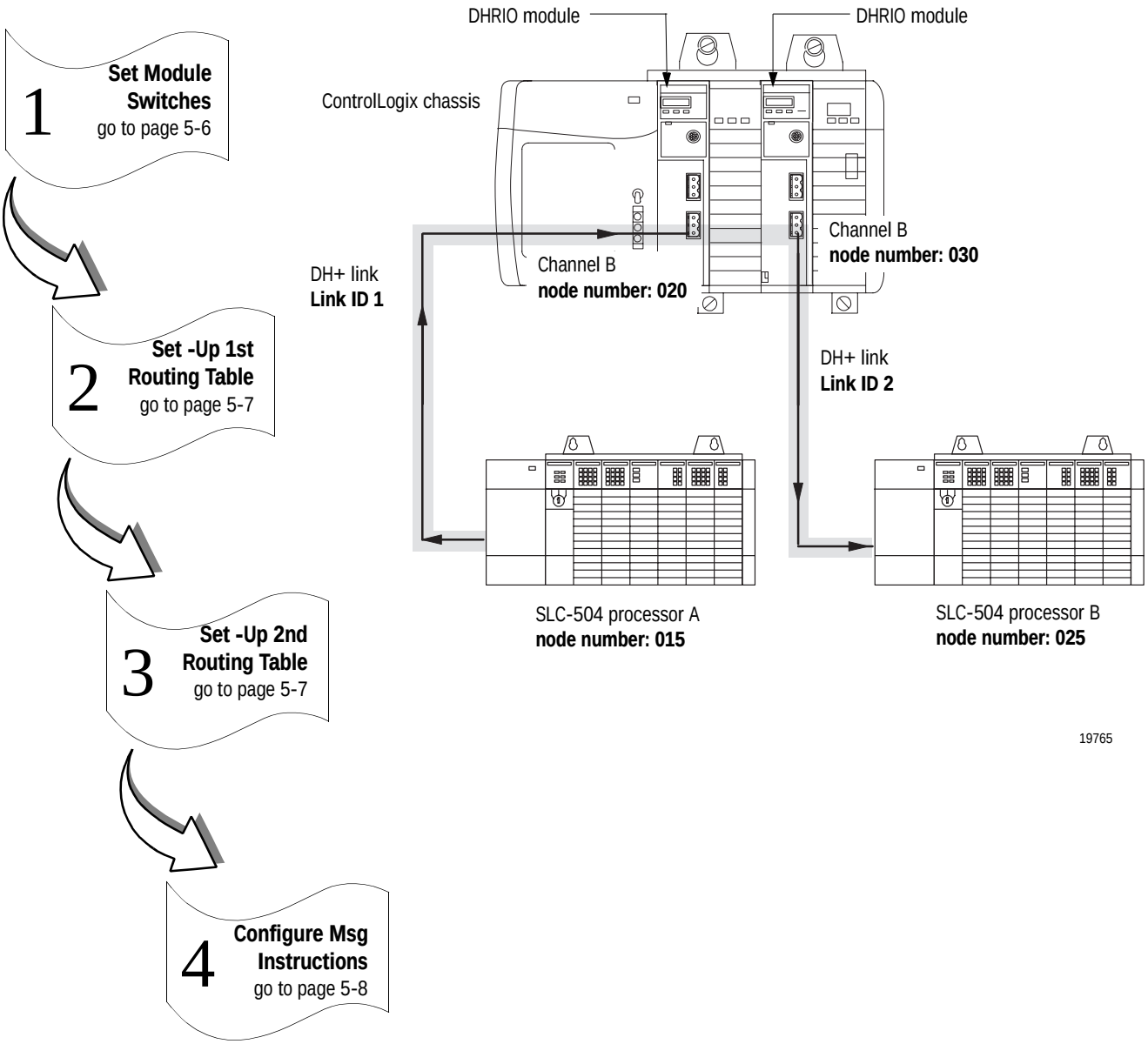
User is not required for your application and typically is set to 0.

For more information on how to configure message instructions using the RSLogix5 software, see the online help for that software.

DH+ Messaging Between SLC-5/04s With Two 1756-DHRIO Modules With One ControlLogix Chassis

This application sends a DH+ message from SLC-504 processor A through two 1756-DHRIO modules in the same chassis to SLC-5/04 processor B. Remote DH+ messaging is required to send the message.

The following diagram illustrates the steps you follow to use such an application:



1 **Set Module Switches**

See setting switches 1-5

Set the Module Switches

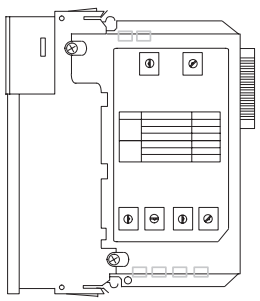
In this application, Channel B on both 1756-DHRIO modules must be set for DH+.

Set the switches as shown below./

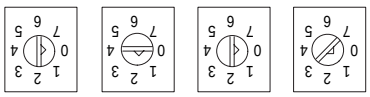
DHRIO module - Slot 0

Both channels are set for DH+.

Channel A Channel B



Channel B switches Channel A switches

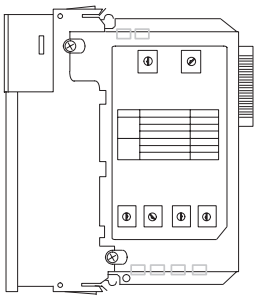


Channel A shows a node address at 10 and channel B at 20.

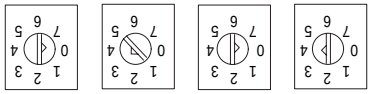
DHRIO module - Slot 2

Both channels are set for DH+.

Channel A Channel B



Channel B switches Channel A switches



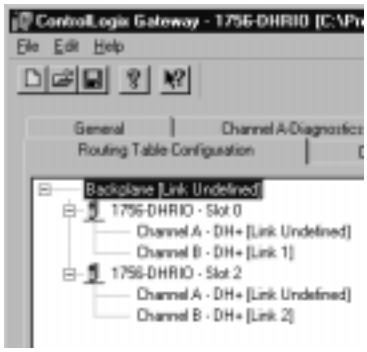
Channel A shows a node address at 40 and channel B at 30.

2 **Set -Up 1st Routing Table**

See remote DH+ messaging 3-6

Set-Up a Routing Table for the First 1756-DHRIO Module

1. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the first 1756-DHRIO module. Your table should look like this:



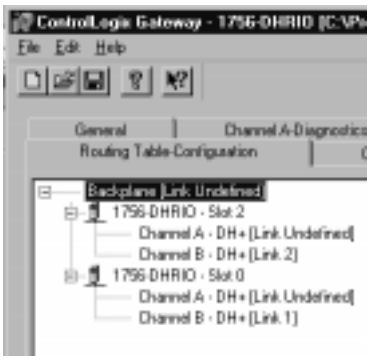
2. Apply the routing table to your application.

3 **Set -Up 2nd Routing Table**

See remote DH+ messaging 3-6

Set-Up a Routing Table for the Second 1756-DHRIO Module

3. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the second 1756-DHRIO module. Your table should look like this:



4. Apply the routing table to your application.

Important: Controller slot values for channels configured for DH+ should be applied or restored to default value, using the appropriate software tabs.

In this example, controller values do not matter, but failure to enter a value, specific or default, will generate a configuration fault for that channel.

TIP

Because both 1756-DHRIO modules are in the same chassis, you only need to set-up one of the two routing tables and apply it to both modules.

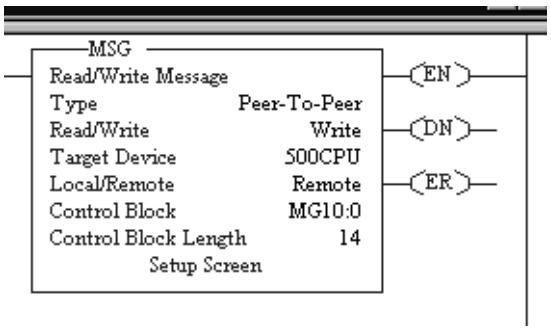
For more information on how to set-up a routing table using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

See SLC-500 Instruction Set Reference, publication 1747-6.15

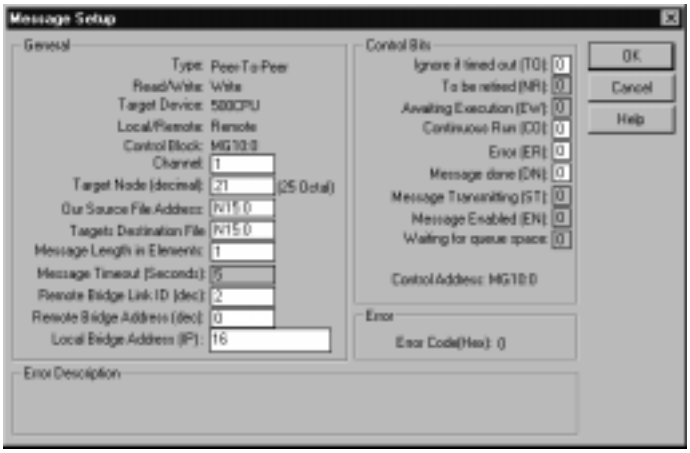
Configure Message Instructions

You must use RSLogix500 to configure the SLC-504 message instructions. Your message instructions should look like this:

Ladder rung



Setup screen



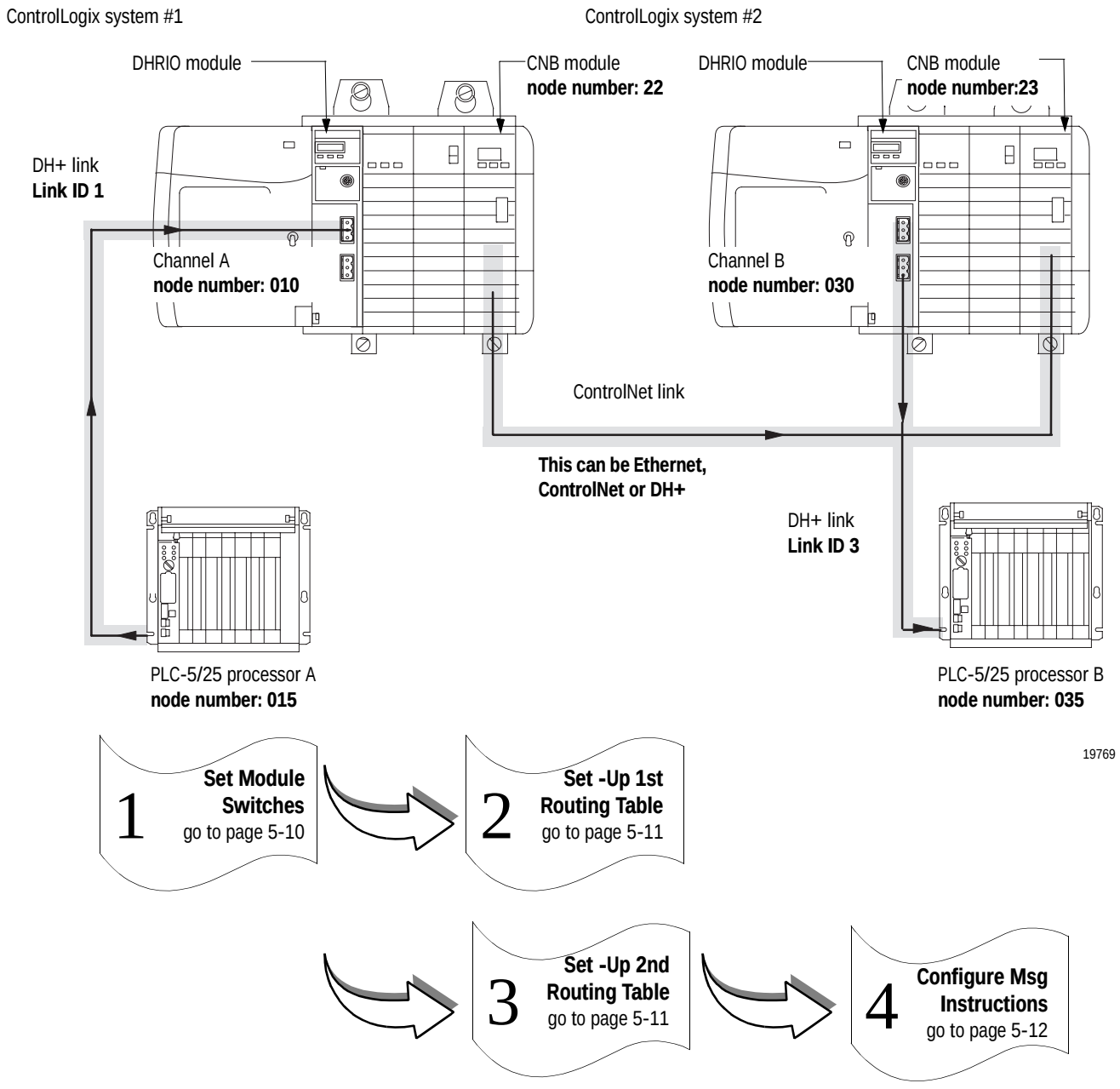
Important: RSLogix 500 displays nodes and link IDs in decimal. Also, in this application, a remote bridge address is not required.

For more information on how to configure message instructions using the RSLogix500 software, see the online help for that software.

DH+ Messaging Between PLC-5s With Multiple ControlLogix Chassis

This application sends a DH+ message from PLC-5 processor A through 1756-DHRIO modules in separate chassis over ControlNet to PLC-5 processor B. Remote DH+ messaging is required to send the message.

The following diagram illustrates the steps you follow to use such an application:



1 **Set Module Switches**

See setting switches 1-5

Set the Module Switches

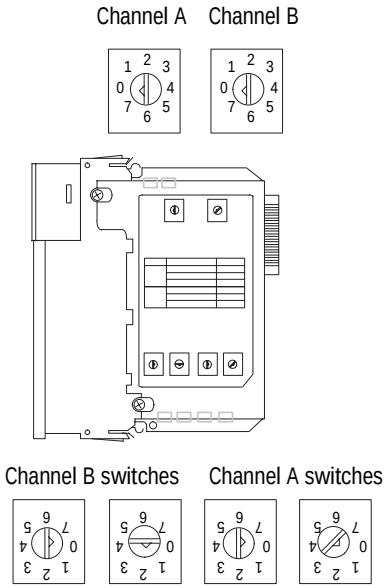
In this application, you must set switches on the 1756-DHRIO modules for DH+ and the switches on the 1756-CNB modules to the correct node addresses.

Important: The switches on the 1756-CNB modules must match the information in the 1756-DHRIO routing tables.

Set the channels as shown.

DHRIO module -Chassis 1
Slot 0

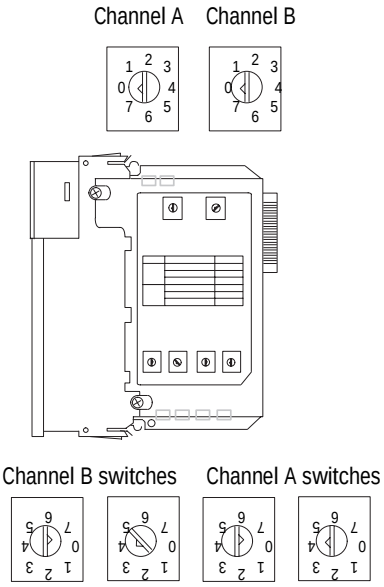
Both channels are set for DH+.



Channel A shows a node address at 010 and channel B at 020.

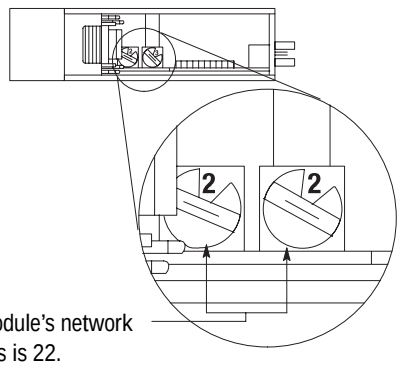
DHRIO module -Chassis 2
Slot 0

Both channels are set for DH+.



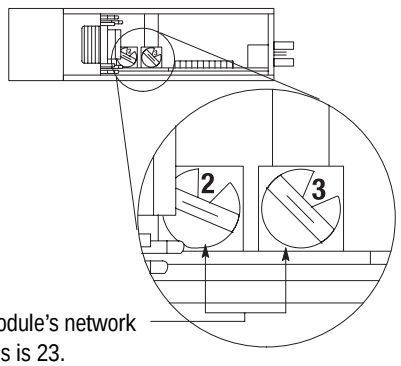
Channel A shows a node address at 040 and channel B at 030.

CNB module - Chassis 1
Slot 3



The module's network address is 22.

CNB module - Chassis 2
Slot 3



The module's network address is 23.

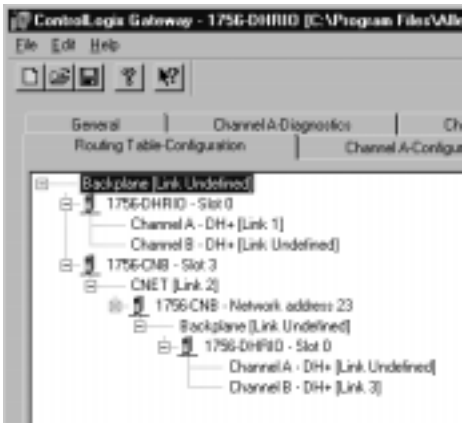
41434

2 Set -Up 1st Routing Table

See remote DH+ messaging 3-6

Set-Up a Routing Table for the First 1756-DHRIO Module

1. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the first 1756-DHRIO module. Your table should look like this:



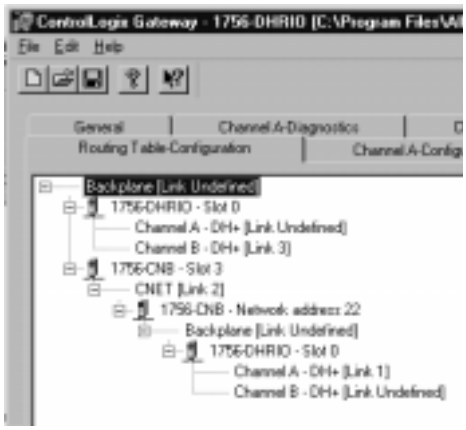
2. Apply the routing table to your application.

3 Set -Up 2nd Routing Table

See remote DH+ messaging 3-6

Set-Up a Routing Table for the Second 1756-DHRIO Module

3. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the first 1756-DHRIO module. Your table should look like this:



4. Apply the routing table to your application.

Important: Controller slot values for channels configured for DH+ should be applied or restored to default value, using the appropriate software tabs.

In this example, controller values do not matter, but failure to enter a value, specific or default, will generate a configuration fault for that channel.

For more information on how to set-up a routing table using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

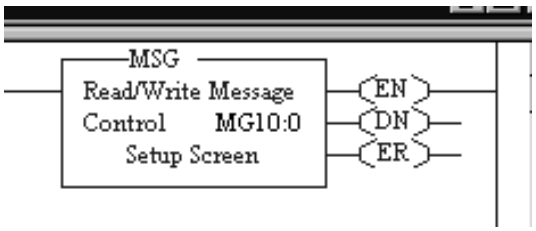
4 **Configure Msg Instructions**

See PLC-5 Instruction set reference, publication 1785-6.1

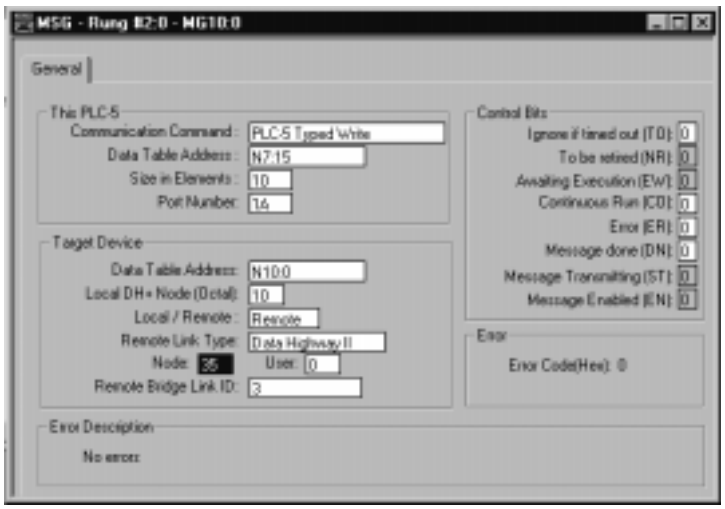
Configure Message Instructions

You must use RSLogix5 to configure the PLC-5 message instructions. Your message instructions should look like this:

Ladder rung



Setup screen



Important: When choosing a *Remote Link Type* in RSLogix 5, you can choose either *Data Highway* or *Data Highway II*. The *User* field only appears in Data Highway II.

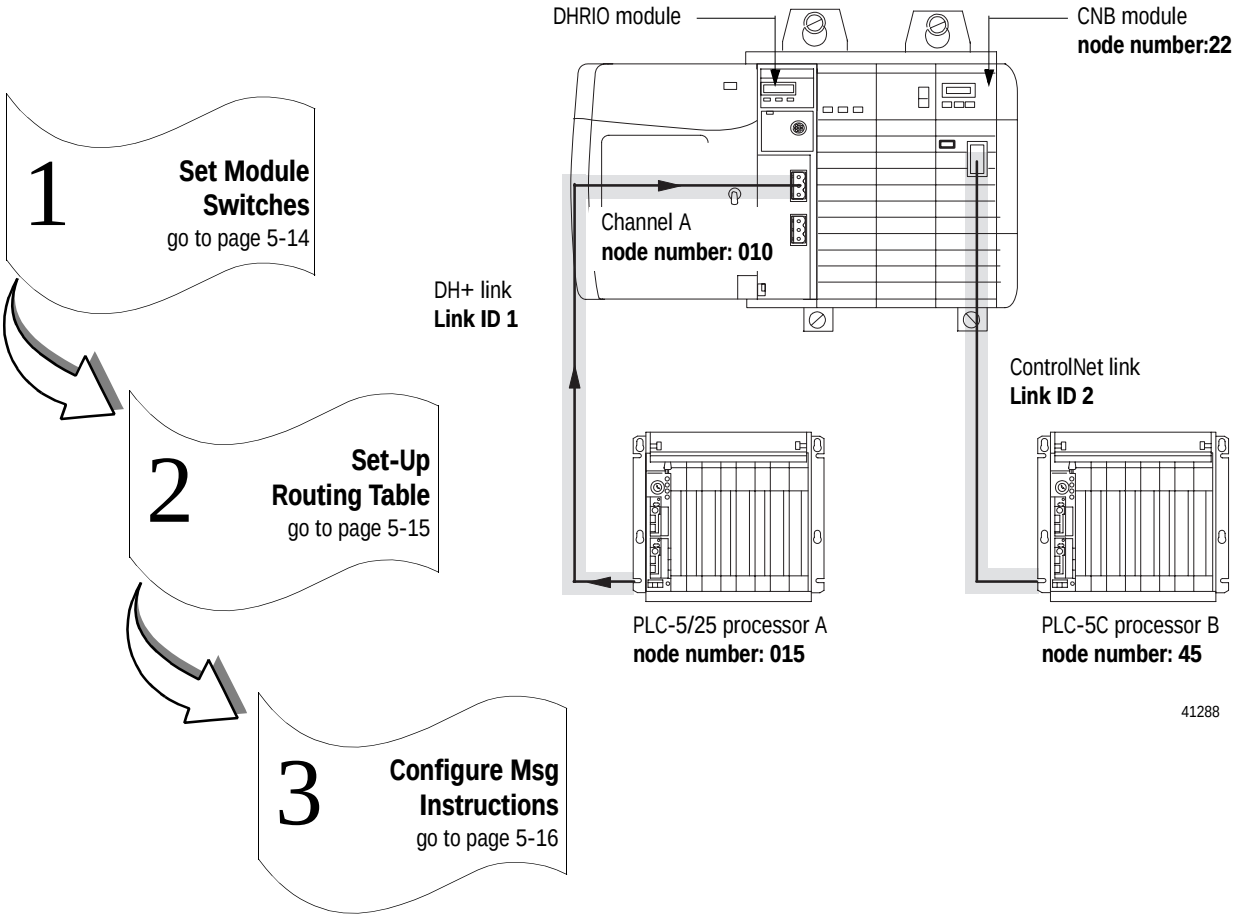
User is not required for your application and typically is set to 0.

For more information on how to configure message instructions using the RSLogix5 software, see the online help for that software.

DH+ Messaging From PLC-5 to PLC-5/C on ControlNet

This application sends a DH+ message from PLC-5 processor A through 1756-DHRIO and 1756-CNB modules to PLC-5C processor B on ControlNet. Remote DH+ messaging is required to send the message.

The following diagram illustrates the steps you follow to use such an application:



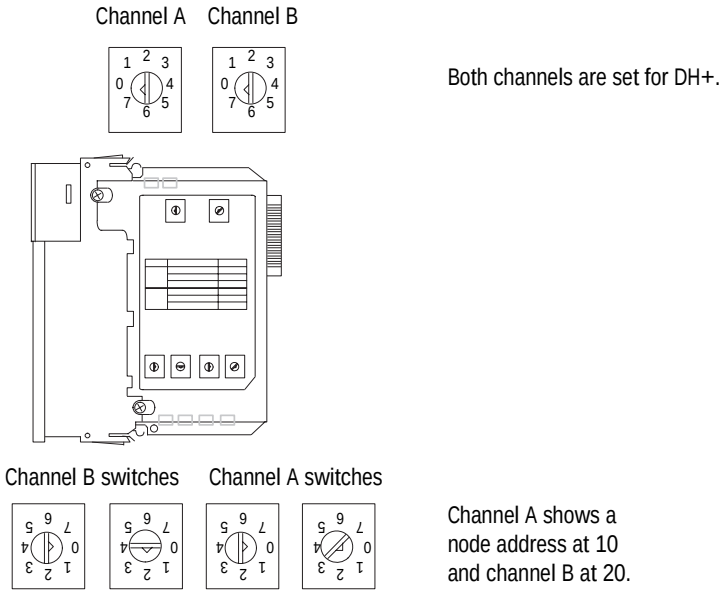
1 **Set Module Switches**

See setting switches 1-5

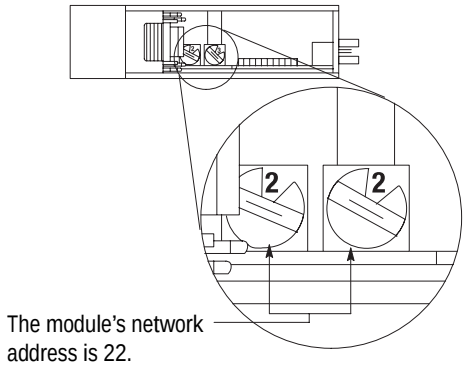
Set the Module Switches

In this application, you must set switches on the 1756-DHRIO module for DH+ and the switches on the 1756-CNB module to the correct node addresses

Set the channels as shown.



CNB module - Chassis 1
Slot 3

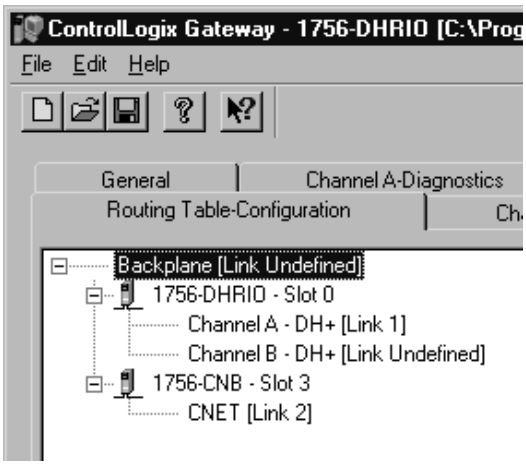


2 Set -Up Routing Table

See remote DH+ messaging 3-6

Set-Up a Routing Table for the 1756-DHRIO Module

1. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the 1756-DHRIO module. Your table should look like this:



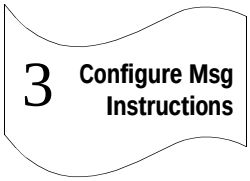
2. Apply the routing table to your application.

Important: Controller slot values for channels configured for DH+ should be applied or restored to default value, using the appropriate software tabs.

In this example, controller values do not matter, but failure to enter a value, specific or default, will generate a configuration fault for that channel.

For more information . . .

For more information on how to set-up a routing table using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

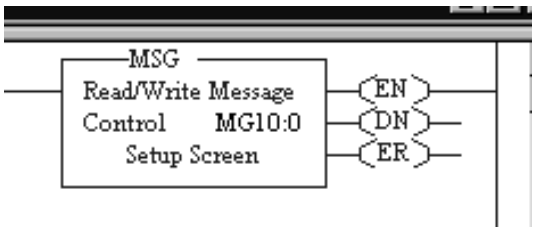


See PLC-5 Instruction set reference, publication 1785-6.1

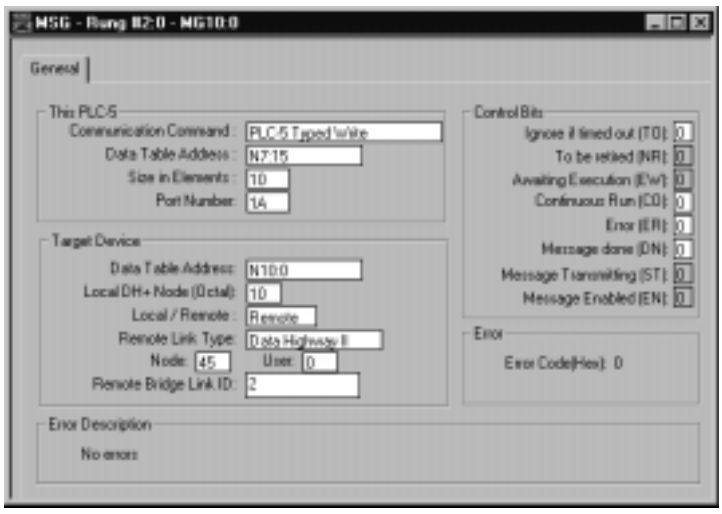
Configure Message Instructions

You must use RSLogix5 to configure the PLC-5 message instructions. Your message instructions should look like this:

Ladder rung



Setup screen



For more information on how to configure message instructions using the RSLogix5 software, see the online help for that software.

Important: When choosing a *Remote Link Type* in RSLogix 5, you can choose either *Data Highway* or *Data Highway II*. The *User* field only appears in Data Highway II.

User is not required for your application and typically is set to 0.

Chapter Summary and What's Next

In this chapter, you learned about using messaging.

Move to Chapter 6 to learn about PLC to Logix5550 messaging.

PLC-5 or SLC-5/04 to Logix5550 Messaging

What This Chapter Contains

This chapter describes how to use DH+ messaging between PLC-5s or SLC-5/04s and a Logix5550. The following table describes what this chapter contains and its location:

For information about using:	See page:
DH+ Messaging From a PLC-5 to One Logix5550 with One ControlLogix Chassis	6-2
DH+ Messaging From a PLC-5 to Multiple Logix5550s with One ControlLogix Chassis	6-6
DH+ Messaging From an SLC-5/04 to a Logix5550 with Multiple ControlLogix Chassis	6-12
Chapter Summary and What's Next	6-16

This chapter contains three example applications. Each example explains what steps must be taken to perform these operations.

Important: The examples use PLC-5s and SLC-5/04s to send DH+ messages. In each case, the use of these devices is strictly for example purposes and not an indication of restrictions on the 1756-DHRIO module.

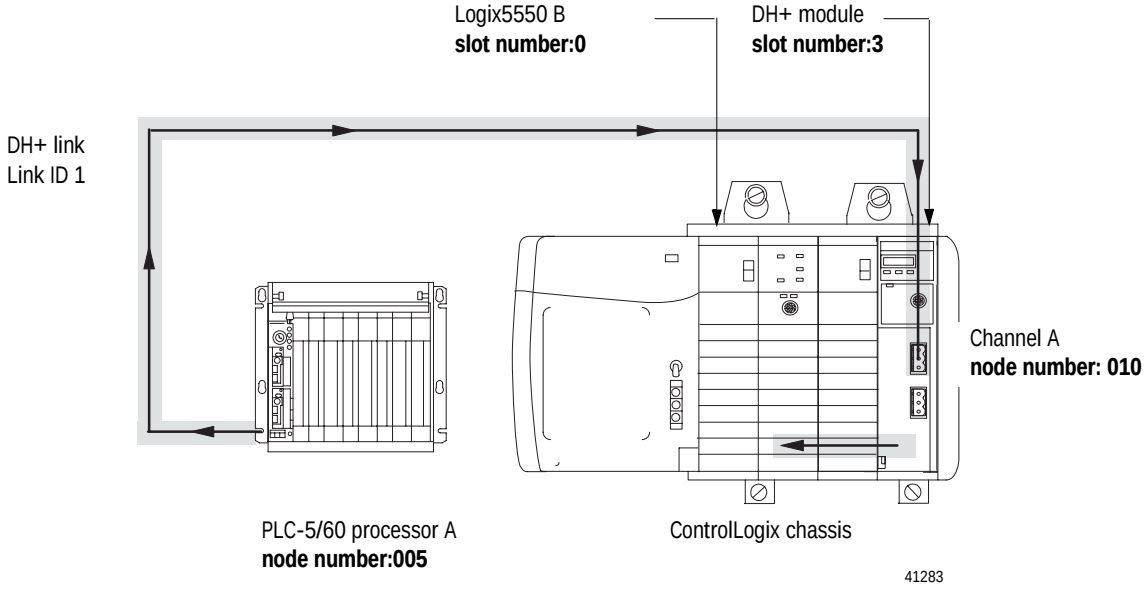
Examples using PLC-5s could, in fact, use SLC-5/04s and examples using SLC-5/04s could use PLC-5s.

DH+ Messaging From a PLC-5 to One Logix5550 With One ControlLogix Chassis

This application sends a DH+ message from PLC-5/60 processor A through a 1756-DHRIO module to Logix5550 B. Local DH+ messaging may be used to send the message.

Important: Local DH+ messaging can only send DH+ messages to one Logix5550 per DH+ channel. See the next application if you want to send DH+ messages to multiple Logix5550s in the chassis.

The following diagram illustrates the steps you must use in this application:



Important: For this application, the 1756-DHRIO module only needs a controller slot programmed if the Logix5550 is not located in the default slot (0) of the ControlLogix chassis.

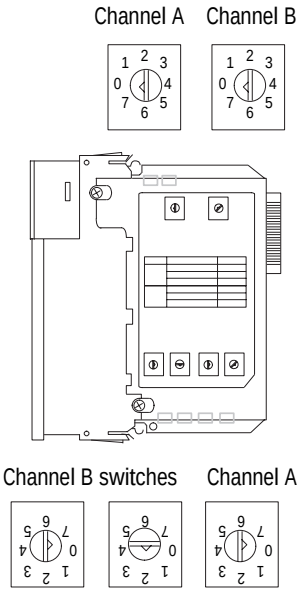
1 **Set Module Switches**

See setting switches 1-5

Set the Module Switches

In this application, channel A on the 1756-DHRIO module must be set for DH+.

Set the channels as shown.



Both channels are set for DH+.

Channel A shows a node address at 10.

41414

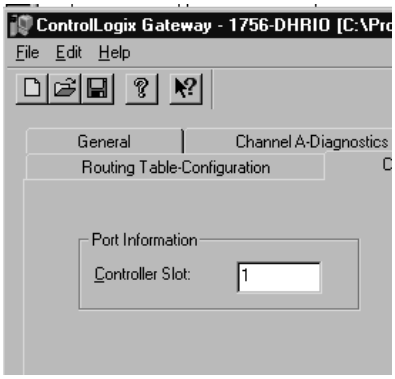
See remote DH+ messaging 3-6

Set-Up a Controller Slot for the 1756-DHRIO Module

If the Logix5550 is located in slot 0 of the ControlLogix chassis, you do not need to modify the controller slot.

If the Logix5550 is not located in the default slot (slot 0) of the ControlLogix chassis, you must use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a controller slot for the 1756-DHRIO module.

1. In this example, you must enter the controller slot number on the channel A configuration page because the Logix5550 is not located in the default configuration slot.



2. Apply the controller slot number to your application.

Important: Controller slot values for the other channel, if it is configured for DH+, should be applied or restored to default value, using the appropriate software tabs.

In this example, controller values applied to the channel not used for DH+ messaging do not matter, but failure to enter a value will generate a configuration fault for that channel.

A routing table is not required for local DH+ messaging. However, if a routing table is programmed, verify it is programmed correctly and applied or set to default. Failure to do so may generate a configuration fault.

For more information . . .

For more information on how to set-up a controller slot using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

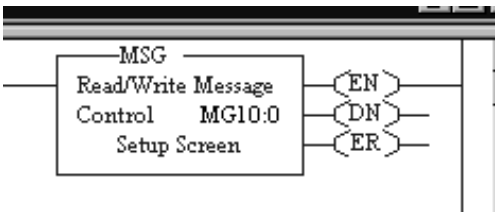
3 **Configure Msg Instructions**

See PLC-5 Instruction Set Reference, publication 1785-6.1

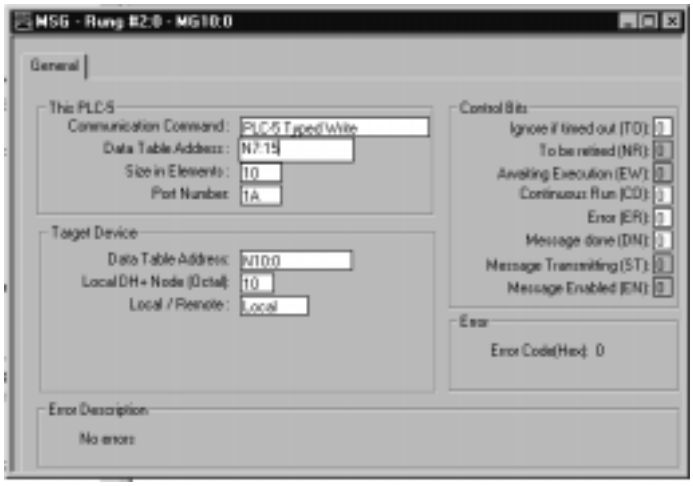
Configure Message Instructions

You must use RSLogix5 to configure the PLC-5 message instructions. Your message instructions should look like this:

Ladder rung



Setup screen



For more information on how to configure message instructions using the RSLogix5 software, see the online help for that software.

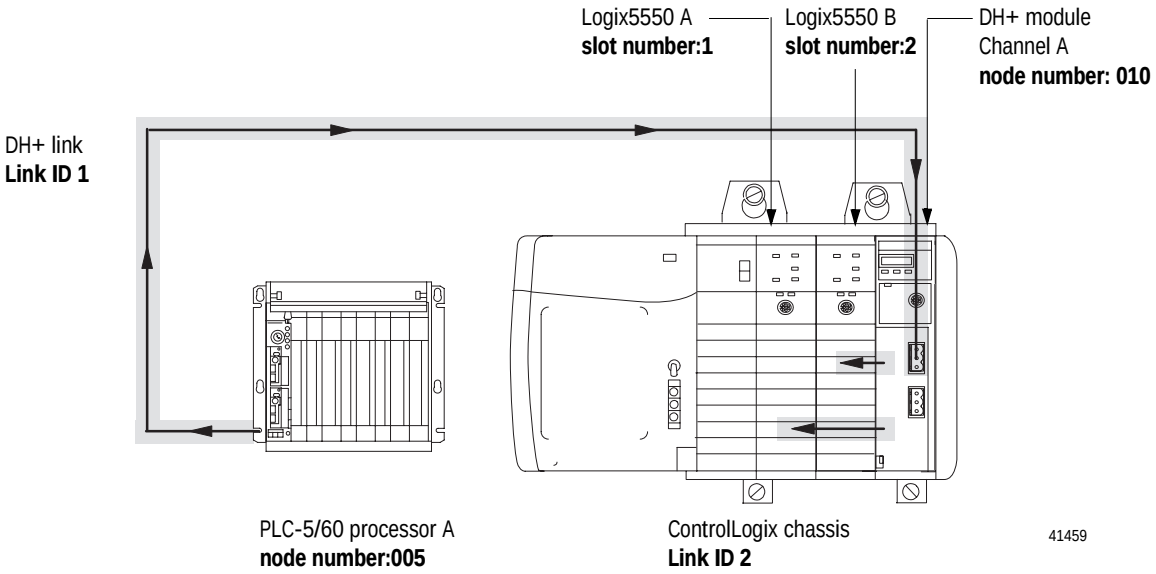
DH+ Messaging From a PLC-5 to Multiple Logix5550s With One ControlLogix Chassis

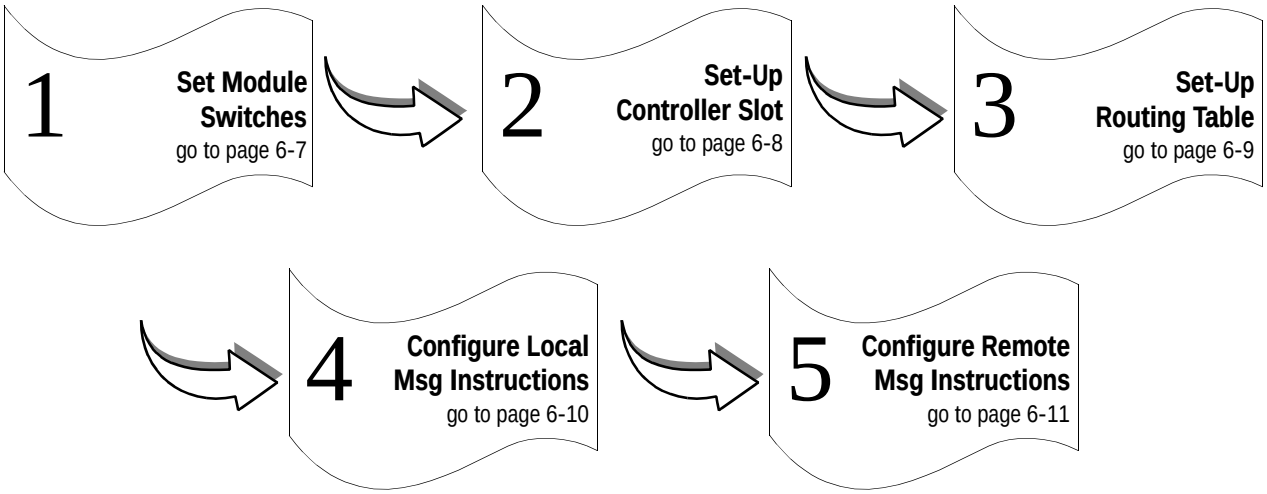
This application sends a DH+ message from PLC-5/60 processor A through a 1756-DHRIO module to more than one Logix5550 in the chassis.

Important: In this example, we use both local and remote DH+ messaging to send DH+ messages. Local DH+ messaging is used to send a message to Logix5550 A. (This processor must be configured as the controller slot, see Step 2.)

Remote DH+ messaging is used to send a message to Logix5550 B. Separate message instructions must be configured in RSLogix 5 for each Logix5550.

The following diagram illustrates the steps you follow to use such an application:





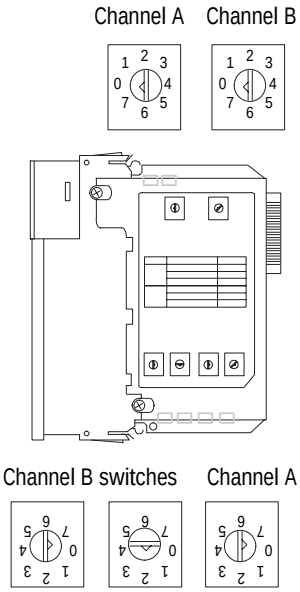
1 **Set Module Switches**

See setting switches 1-5

Set the Module Switches

In this application, channel A on the 1756-DHRIO module must be set for DH+.

Set the channels as shown.



Both channels are set for DH+.

Channel A shows a node address at 10.

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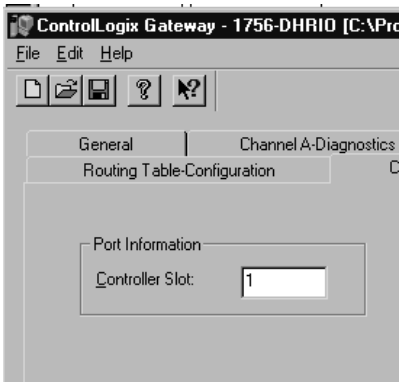
See remote DH+ messaging 3-6

Set-Up a Controller Slot for the 1756-DHRIO Module

If the Logix5550 is located in slot 0 of the ControlLogix chassis, you do not need to modify the controller slot.

If the Logix5550 is not located in the default slot (slot 0) of the ControlLogix chassis, you must use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a controller slot for the 1756-DHRIO module.

1. In this example, you must enter the controller slot number on the channel A configuration page because the Logix5550 is not located in the default configuration slot.



2. Apply the controller slot number to your application.

Important: Controller slot values for the other channel, if it is configured for DH+, should be applied or restored to default value, using the appropriate software tabs.

In this example, controller values applied to the channel not used for DH+ messaging do not matter, but failure to enter a value will generate a configuration fault for that channel.

For more information . . .

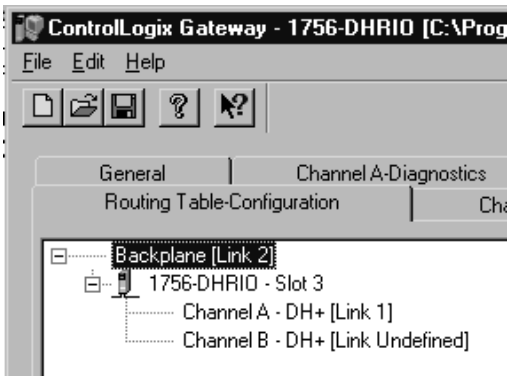
For more information on how to set-up a controller slot using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

3 **Set -Up Routing Table**

See remote DH+ messaging 3-6

Set-Up a Routing Table for the 1756-DHRIO Module

1. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the 1756-DHRIO module. Your table should look like this:



2. Apply the routing table to your application.

For more information . . .

For more information on how to set-up a routing table using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

4 Configure Local Msg Instructions

See PLC-5 Instruction Set Reference, publication 1785-6.1

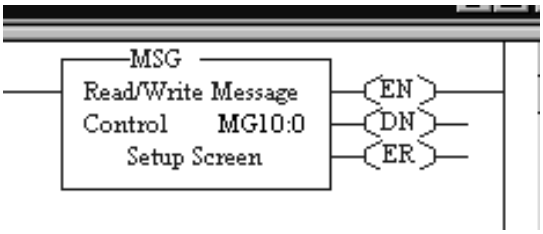
Configure Local Message Instructions

You must use RSLogix5 to configure the PLC-5 message instructions. First configure your local message instructions for the message being sent to Logix5550A in the controller slot.

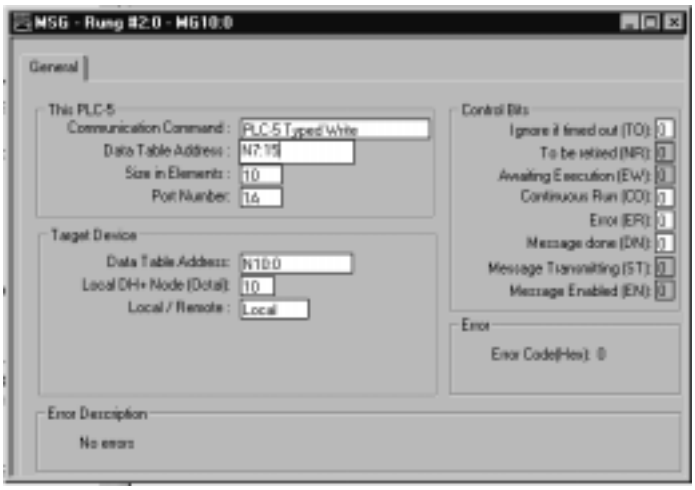
Important: Because this message instruction is sending a message to a Logix5550 in the configured controller slot, you can use a local message instruction.

Your message instructions should look like this:

Ladder rung



Setup screen



For more information on how to configure message instructions using the RSLogix5 software, see the online help for that software.

5 Configure Remote Msg Instructions

See PLC-5 Instruction Set Reference, publication 1785-6.1

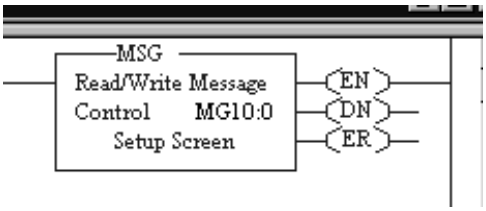
Configure Remote Message Instructions

You must use RSLogix5 to configure the PLC-5 message instructions. In this step, configure your remote message instructions for the message being sent to Logix5550 B.

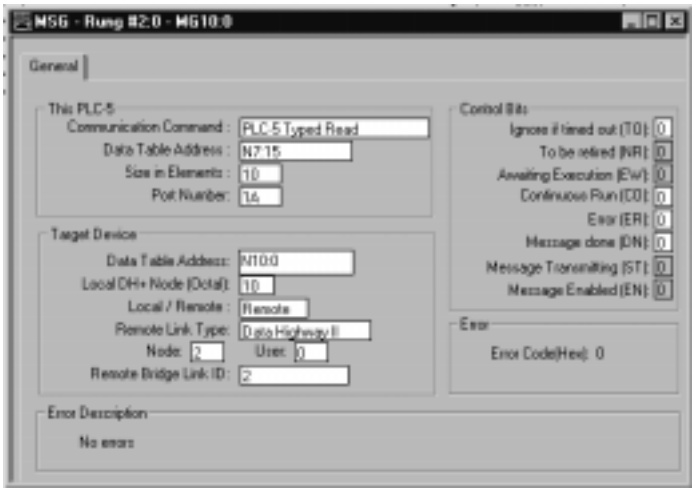
Important: Because this message instruction is sending a message to a Logix5550 not located in the configured controller slot, you must use a remote message instruction.

Your message instructions should look like this:

Ladder rung



Setup screen



Important: When choosing a *Remote Link Type* in RSLogix 5, you can choose either *Data Highway* or *Data Highway II*. The *User* field only appears in Data Highway II.

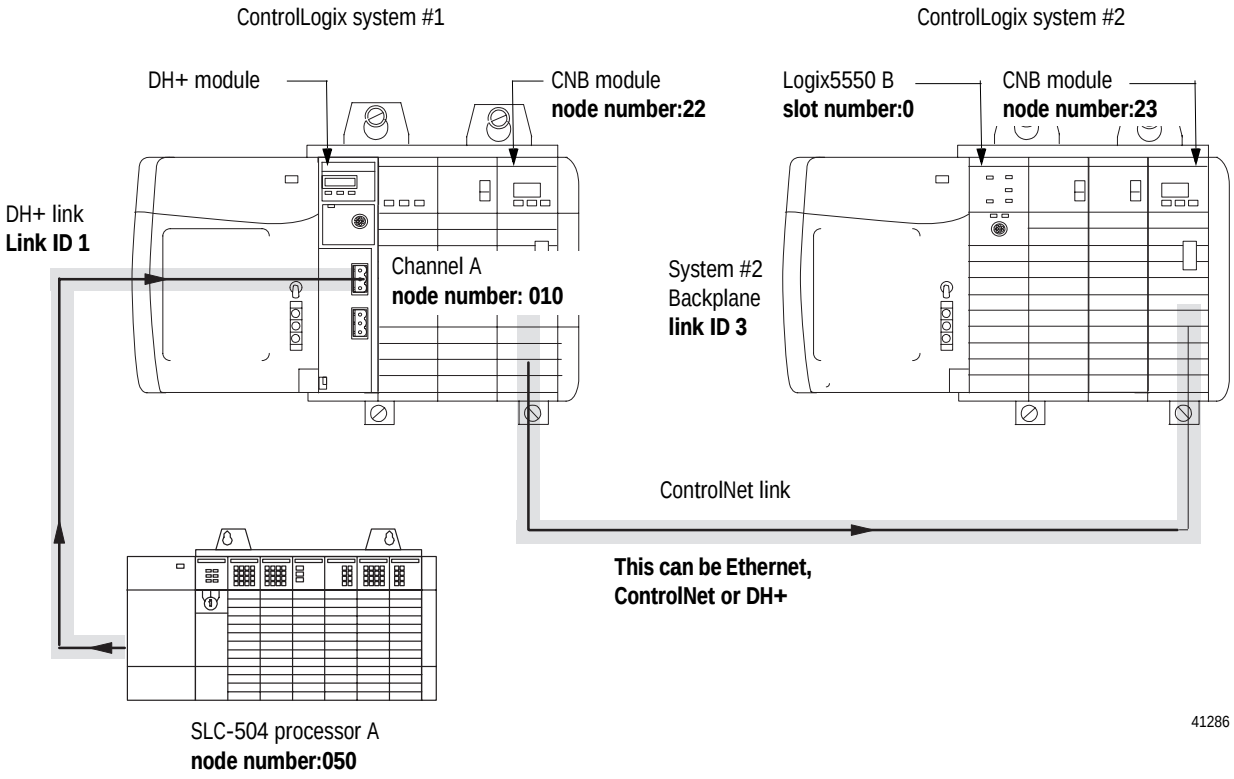
User is not required for your application and typically is set to 0.

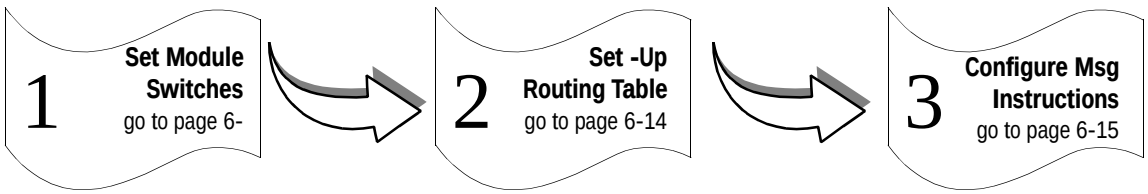
For more information on how to configure message instructions using the RSLogix5 software, see the online help for that software.

DH+ Messaging From a SLC-5/04 to a Logix5550 With Multiple ControlLogix Chassis

This application sends a DH+ message from SLC-5/04 processor A through a 1756-DHRIO module in ControlLogix system #1 to a 1756-DHRIO module in ControlLogix system #2 to Logix5550 B. Remote DH+ messaging is required to send the message.

The following diagram illustrates the steps you follow to use such an application:





1 **Set Module Switches**

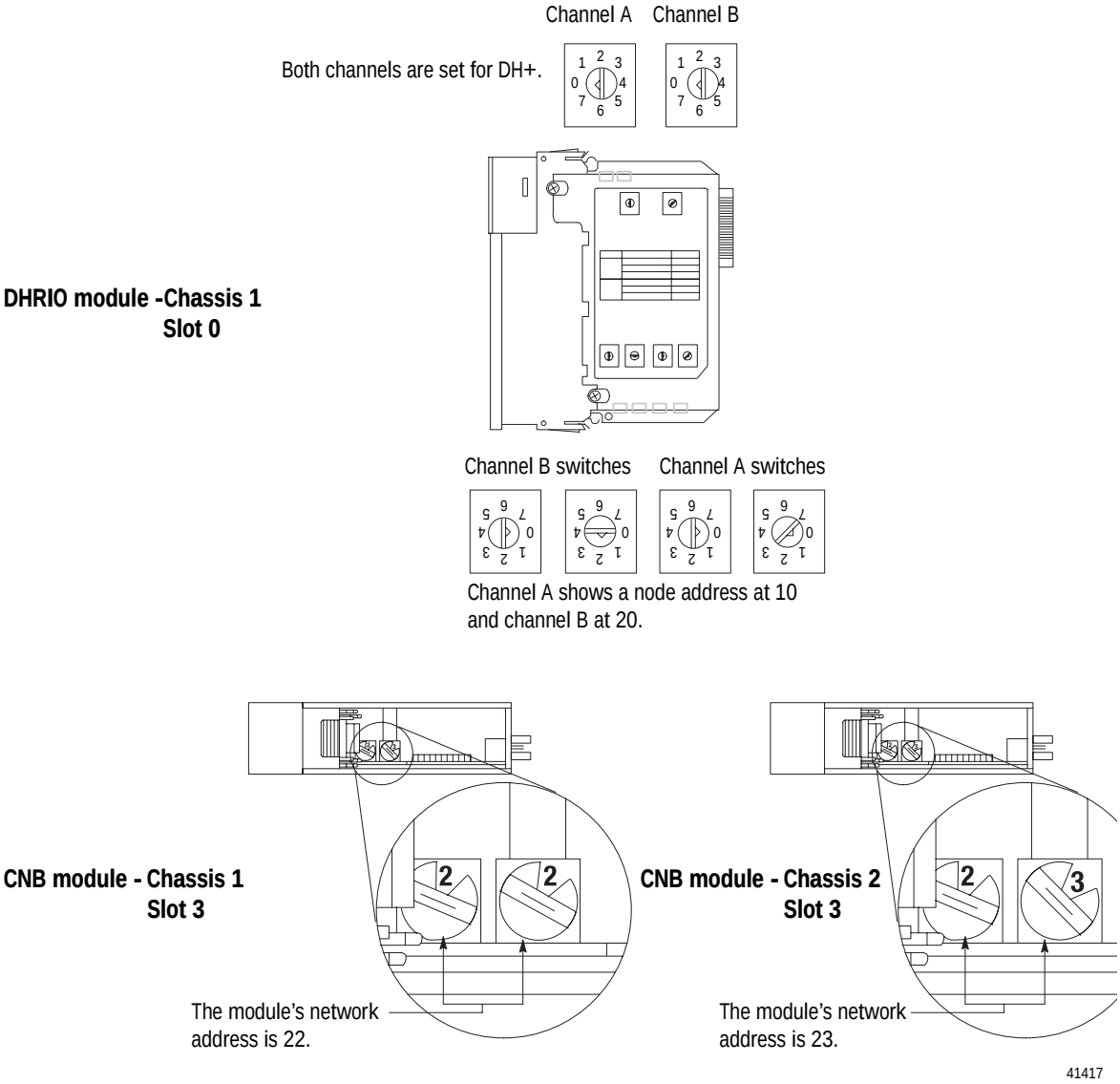
See ControlLogix ControlNet Bridge Installation Instructions, publication 1756-5.32

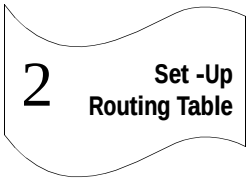
Set the Module Switches

In this application, you must set switches on the 1756-DHRIO modules for DH+ and the switches on the 1756-CNB modules to the correct network addresses.

Important: The switches on the 1756-CNB modules must match the information in the 1756-DHRIO routing tables.

Set the channels as shown.

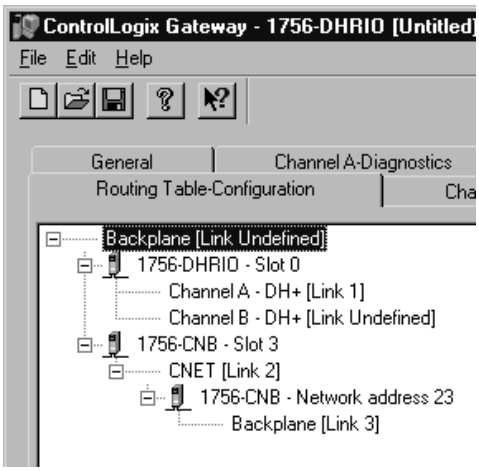




See remote DH+ messaging 3-6

Set-Up a Routing Table for the 1756-DHRIO Module

1. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the 1756-DHRIO module. The table should look like this:



2. Apply the routing table to your application.

Important: Controller slot values for channels configured for DH+ should be applied or restored to default value, using the appropriate software tabs.

In this example, controller values do not matter, but failure to enter a value, specific or default, will generate a configuration fault for that channel.

For more information . . .

For more information on how to set-up a routing table using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

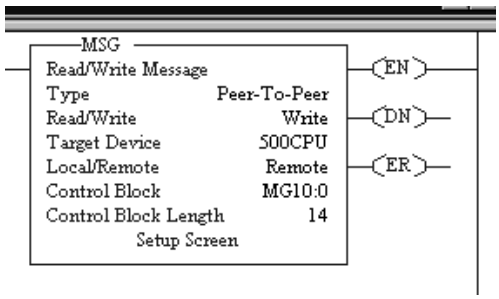
3 **Configure Msg Instructions**

See SLC-500 Instruction Set Reference, publication 1747-6.15

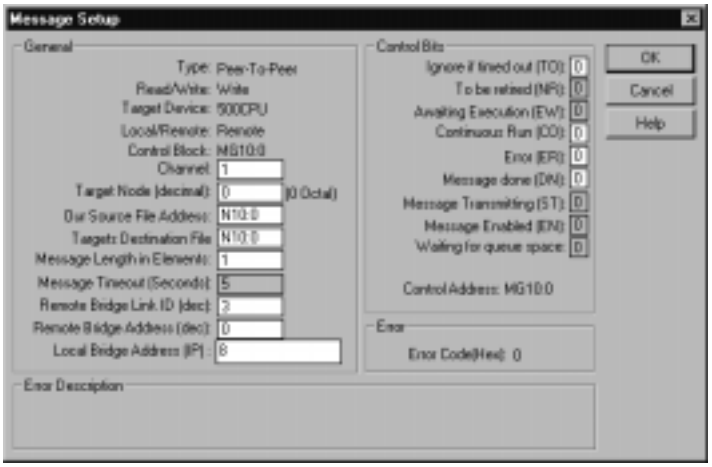
Configure Message Instructions

You must use RSLogix500 to configure the SLC-500 message instructions.Your message instructions should look like this:

Ladder rung



Setup screen



For more information on how to configure message instructions using the RSLogix500 software, see the online help for that software.

Important: RSLogix500 displays nodes and link IDs in decimal. Also, in this application, a remote bridge address is not required.

Chapter Summary and What's Next

In this chapter, you learned about PLC-5 or SLC5/04 to Logix5550 messaging.

Move on to Chapter 7 to learn about Logix5550 to PLC-5 or SLC-5/04 messaging.

Logix5550 to PLC-5 or SLC-5/04 Messaging

What This Chapter Contains

This chapter describes how to use DH+ messaging between a Logix5550 and PLC-5s or SLC-5/04s. The following table describes what this chapter contains and its location.

For information about using:	See page:
DH+ Messaging From a Logix5550 to a PLC-5 With One ControlLogix Chassis	7-2
DH+ Messaging From a Logix5550 to a PLC-5 With Multiple ControlLogix Chassis Over DH+	7-5
DH+ Messaging From a Logix5550 to a SLC-5/04 With Multiple ControlLogix Chassis Over ControlNet and DH+	7-9
Chapter Summary and What's Next	7-13

This chapter contains three example applications. Each example explains what steps must be taken to perform these operations.

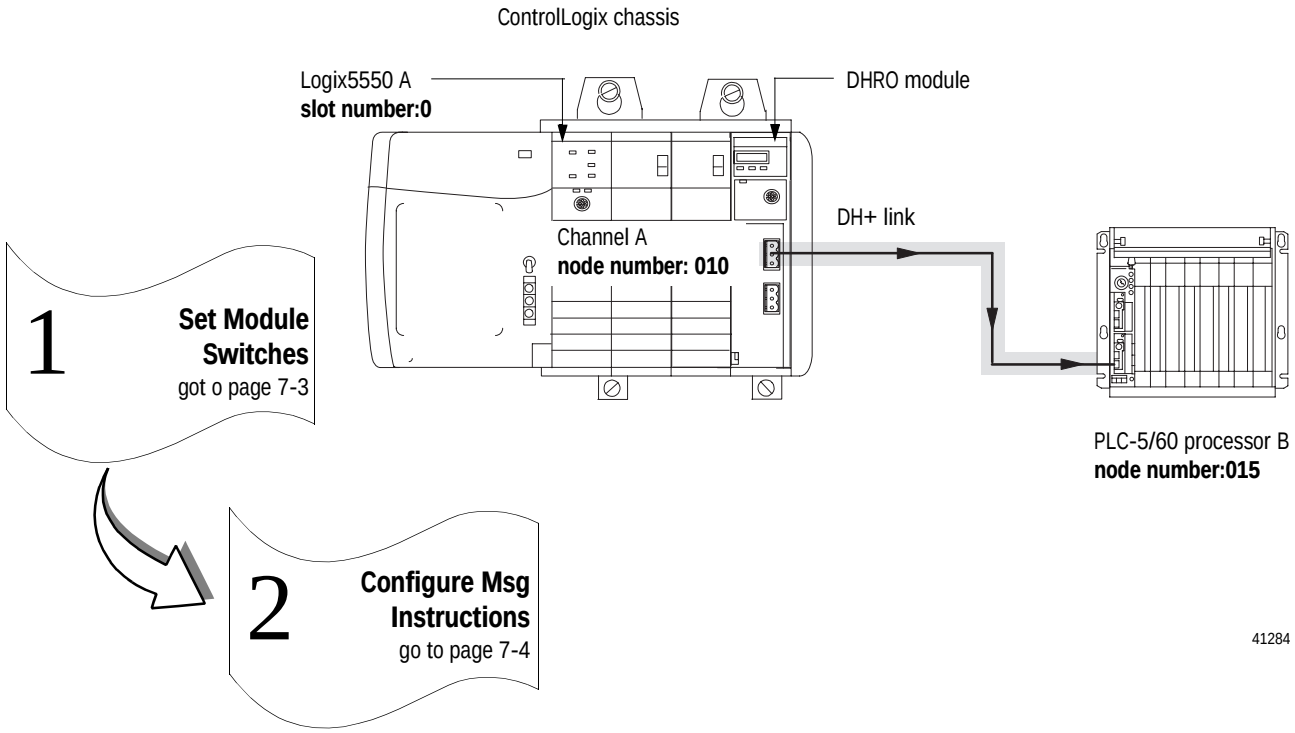
Important: The examples use PLC-5s and SLC-5/04s to send DH+ messages. In each case, the use of these devices is strictly for example purposes and not an indication of restrictions on the 1756-DHRIO module.

Examples using PLC-5s could, in fact, use SLC-504s and examples using SLC-5/04s could use PLC-5s.

Local DH+ Messaging From a Logix5550 to a PLC-5 With One ControlLogix Chassis

This application sends a DH+ message from a Logix5550 A through a 1756-DHRIO module to a PLC-5 processor B on a DH+ link. Local DH+ messaging may be used to send the message. In this case, local DH+ messaging is used.

The following diagram illustrates the steps you follow to use such an application:



Important: When you are using local DH+ messaging between a Logix5550 and a PLC processor, you **do not need** a routing table. (The default setting on the module out of the box is to have no routing table set-up.)

A routing table is not required for local DH+ messaging. However, if a routing table is programmed, verify it is programmed correctly or a configuration fault may occur.

Also, controller slot values for channels configured for DH+ should be applied or restored to default value, using the appropriate software tabs. Failure to enter the correct value will generate a configuration fault for that channel.

For more information . . .

For more information on how to clear a routing table using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

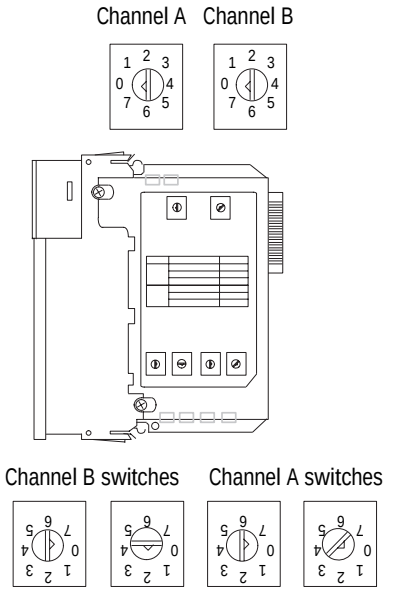
1 **Set Module Switches**

See setting switches 1-5

Set the Module Switches

In this application, channel A on the 1756-DHRIO module must be set for DH+.

Set the channels as shown.



Both channels are set for DH+.

Channel A shows a node address at 10.

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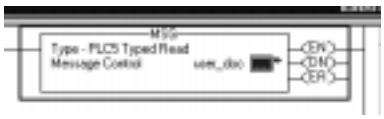
2 **Configure Msg Instructions**

See Logix5550 Instruction Set Reference, publication 1756-6.4.1

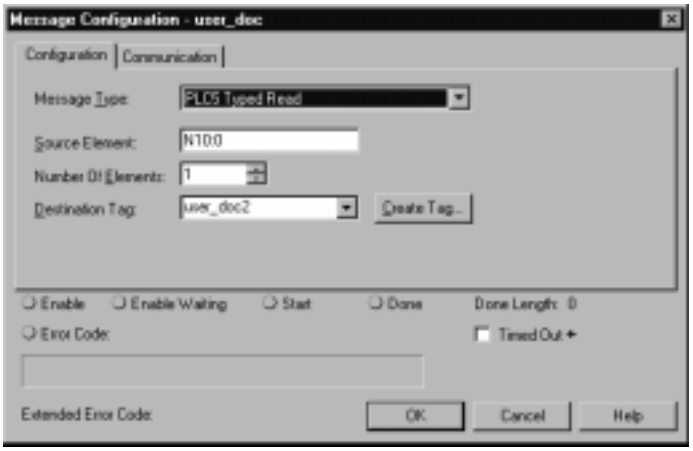
Configure Message Instructions

You must use RSLogix5000 to configure the Logix5550 message instructions.Your message instructions should look like this:

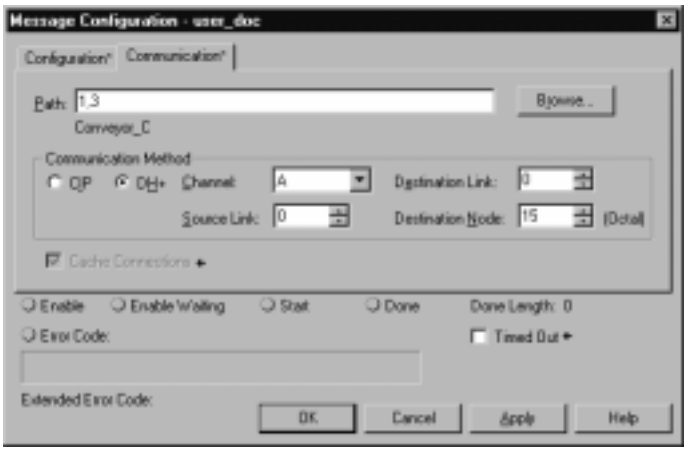
Ladder rung



Configuration page



Communication page



Important: Setting the destination link = 0 causes the 1756-DHRIO module to send the message as a local DH+ message. Also, remember that there are limits to local DH+ messaging. For more information on local DH+ messaging, see chapter 3.

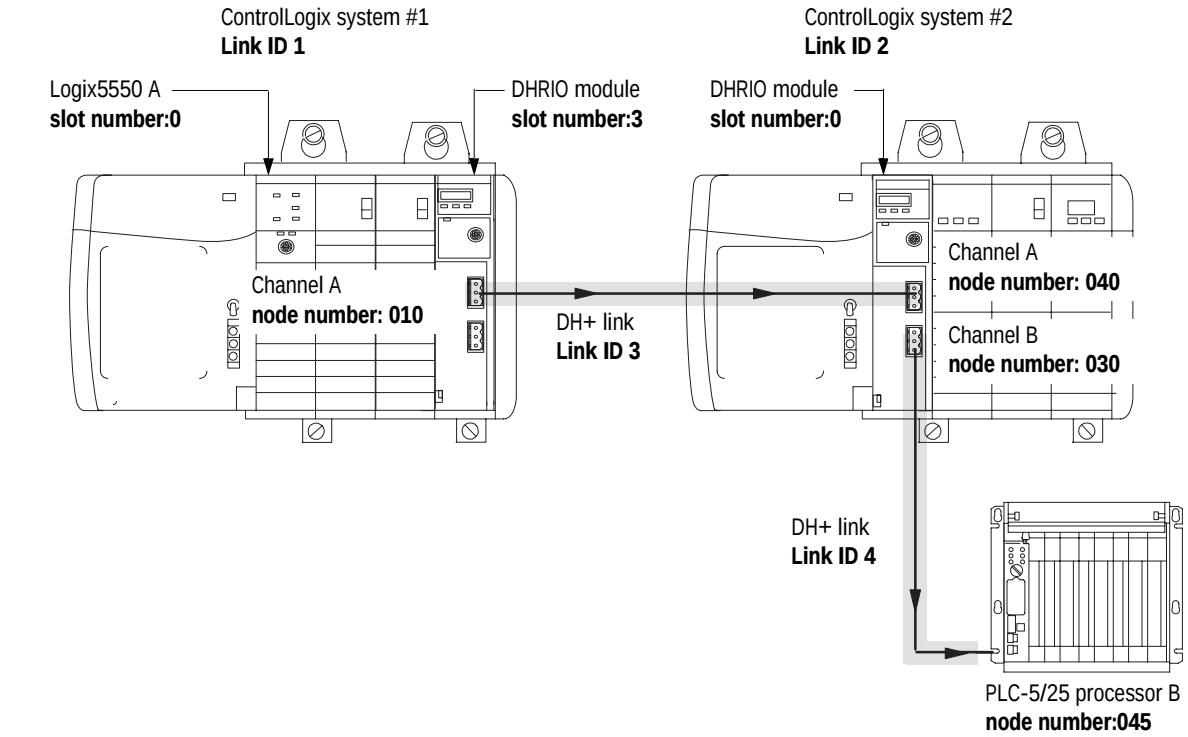
When using DH+ messaging from a Logix5550, the path is the connection path from the Logix5550 to the first 1756-DHRIO module. For more information on connection paths, see chapter 4.

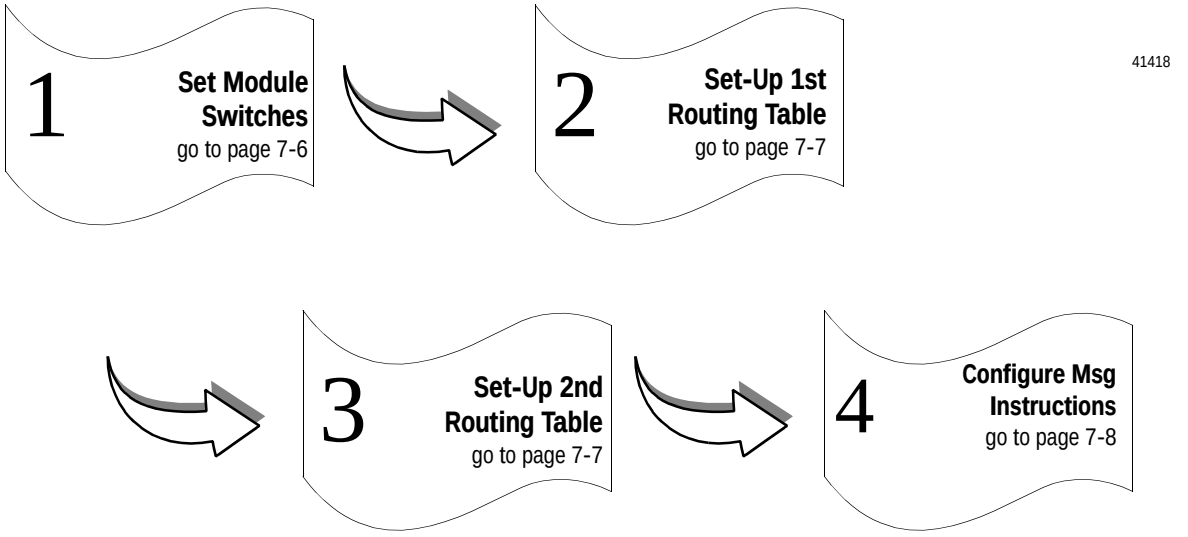
For more information on how to configure message instructions using the RSLogix5000 software, see the online help for that software.

DH+ Messaging From a Logix5550 to a PLC-5 With Multiple ControlLogix Chassis Over DH+

This application sends a DH+ message from a Logix5550 A in one ControlLogix chassis through 1756-DHRIO modules to a PLC-5 processor B on a DH+ link in another ControlLogix chassis. Remote DH+ messaging is required to send the message in this application.

The following diagram illustrates the steps you follow to use such an application:





1 **Set Module Switches**

See setting switches 1-5

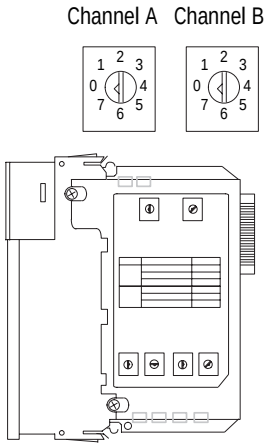
Set the Module Switches

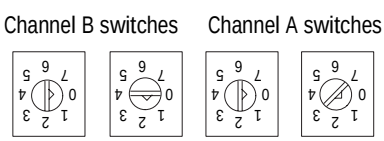
In this application, Channel A on the first 1756-DHRIO module and Channel B on both 1756-DHRIO modules must be set for DH+.

Set the switches as shown below.

DHRIO module
System #1
Slot 3

Both channels are set for DH+.

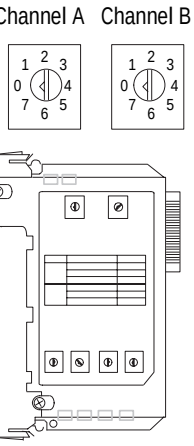


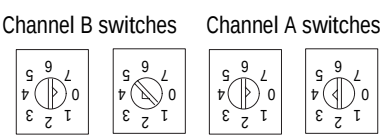


Channel A shows a node address at 10 and channel B at 20.

DHRIO module
System #2
Slot 2

Both channels are set for DH+.





Channel A shows a node address at 40 and channel B at 30.

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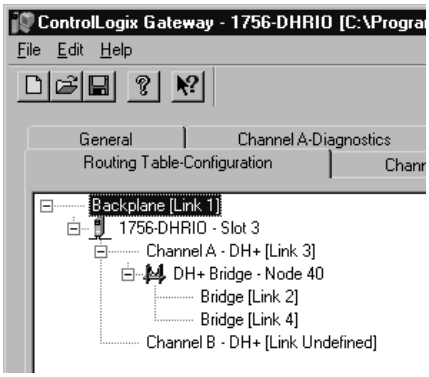
2 **Set -Up 1st Routing Table**

See remote DH+ messaging 3-6

Set-Up a Routing Table for the First 1756-DHRIO Module

1. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the 1756-DHRIO module in ControlLogix system #1. Your table should look like this:



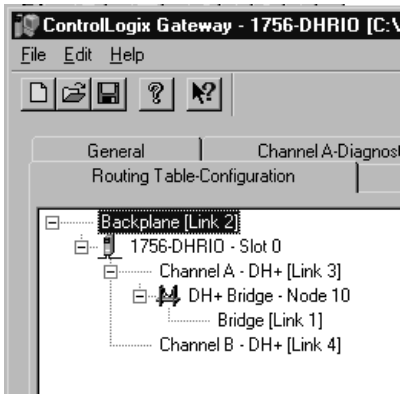
2. Apply the routing table to your application.

3 **Set -Up 2nd Routing Table**

See remote DH+ messaging 3-6

Set-Up a Routing Table for the Second 1756-DHRIO Module

3. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the 1756-DHRIO module in ControlLogix system #2. Your table should look like this:



4. Apply the routing table to your application.

Important: Controller slot values for channels configured for DH+ should be applied or restored to default value, using the appropriate software tabs.

In this example, controller values do not matter, but failure to enter a value, specific or default, will generate a configuration fault for that channel.

For more information . . .

For more information on how to set-up a routing table using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

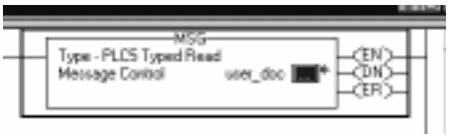
4 **Configure Msg Instructions**

See Logix5550 Instruction Set Reference, publication 1756-6.4.1

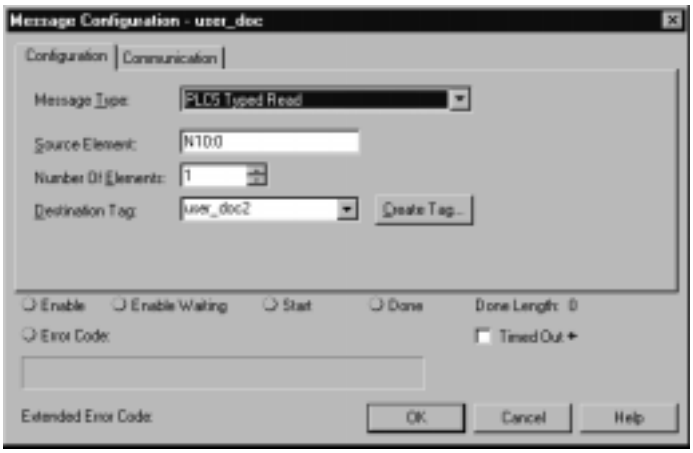
Configure Message Instructions

You must use RSLogix5000 to configure the Logix5550 message instructions.You must use RSLogix5000 to configure the Logix5550 message instructions.Your message instructions should look like this:

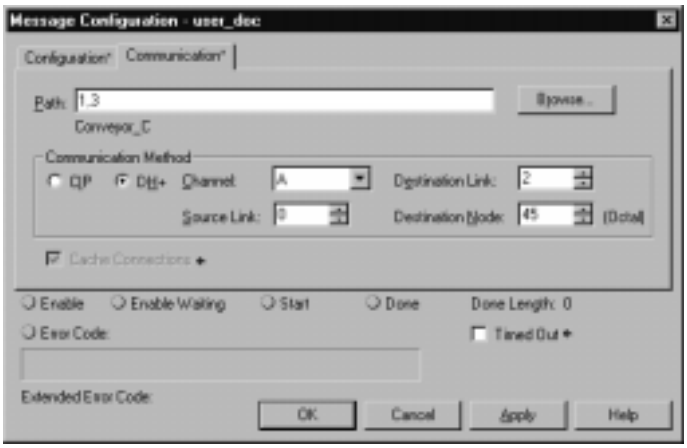
Ladder rung



Configuration page



Communication page



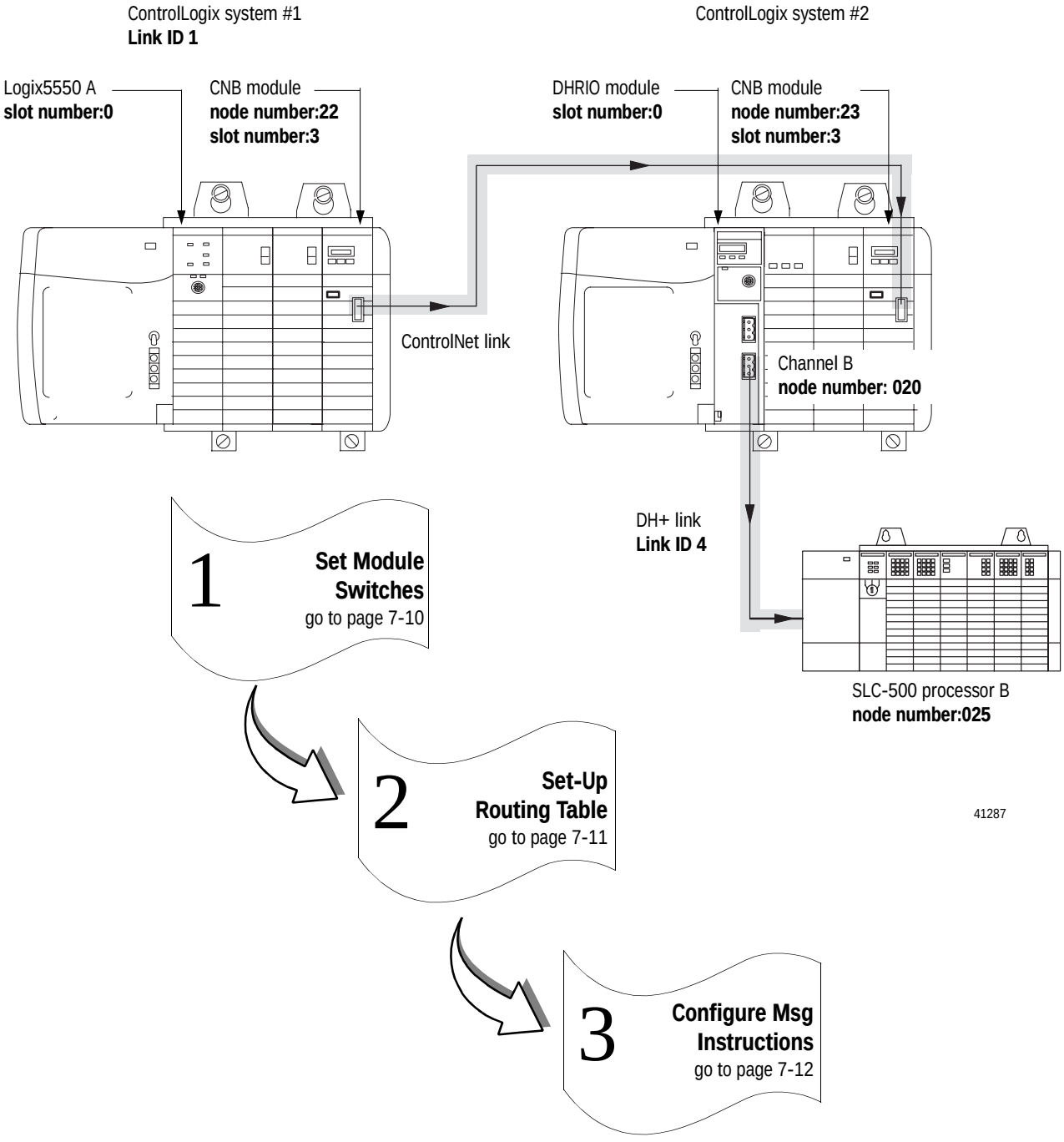
When using DH+ messaging from a Logix5550, the path is the connection path from the Logix5550 to the first 1756-DHRIO module. For more information on connection paths, see chapter 4.

For more information on how to configure message instructions using the RSLogix5000 software, see the online help for that software.

DH+ Messaging From a Logix5550 to a SLC-5/04 Over ControlNet and DH+ With Multiple ControlLogix Chassis

This application sends a DH+ message from Logix5550 A to SLC-5/04 processor B over ControlNet and DH+. Remote DH+ messaging is used to send the message in this application.

The following diagram illustrates the steps you follow to use such an application:



1 **Set Module Switches**

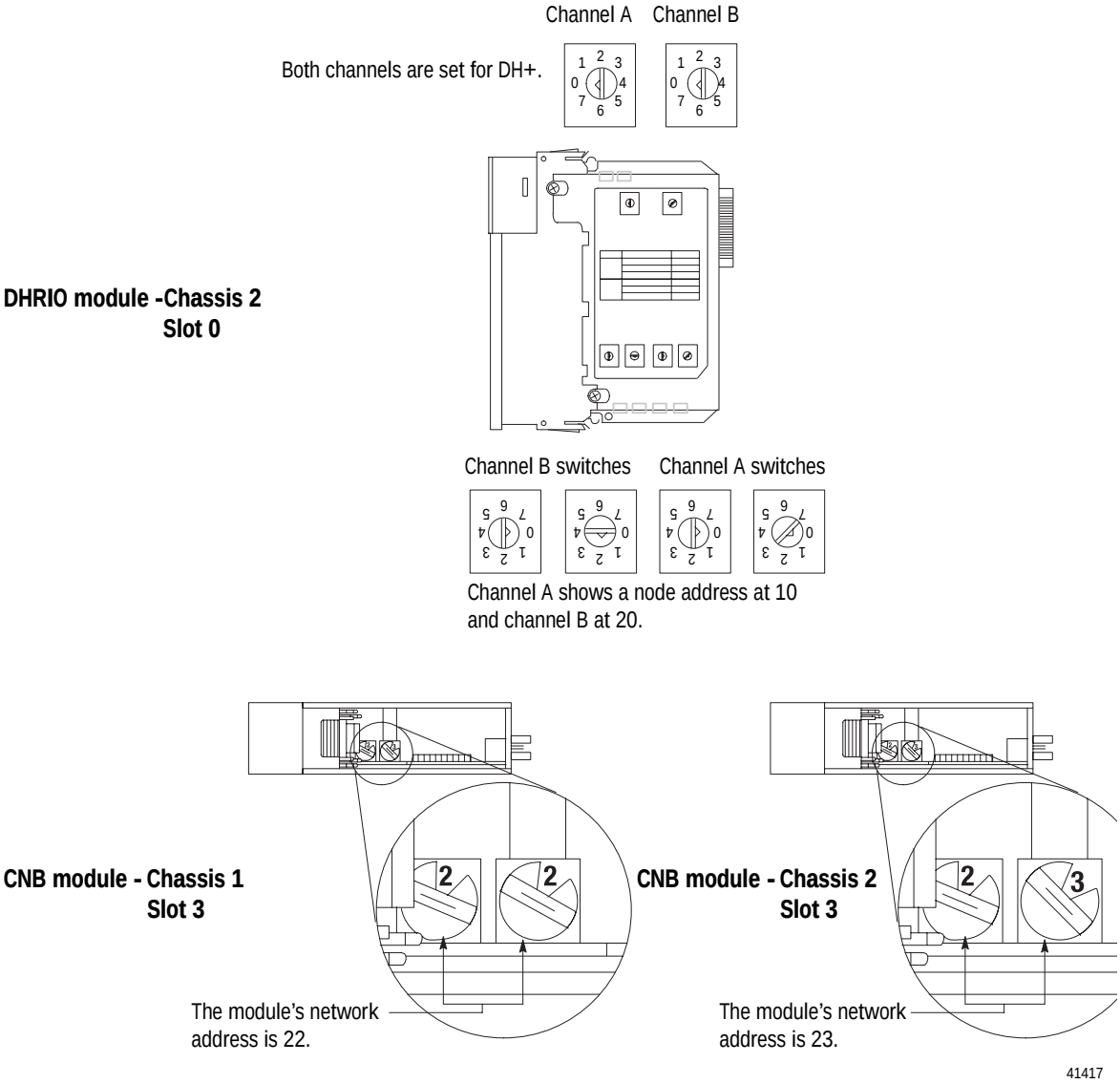
See ControlLogix ControlNet Bridge Installation Instructions, publication 1756-5.32

Set the Module Switches

In this application, you must set switches on the 1756-DHRIO modules for DH+ and the switches on the 1756-CNB modules to the correct network addresses.

Important: The switches on the 1756-CNB modules must match the information in the 1756-DHRIO routing tables.

Set the channels as shown.

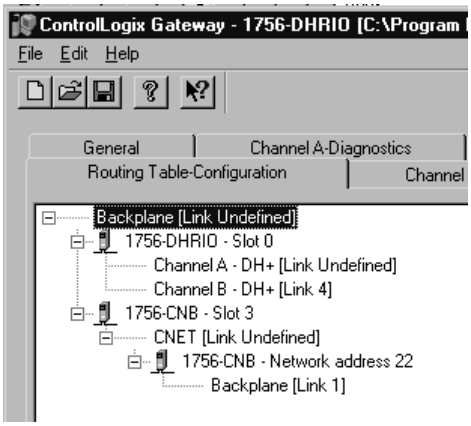


2 **Set -Up Routing Table**

See remote DH+ messaging 3-6

Set-Up a Routing Table for the 1756-DHRIO Module

1. Use the ControlLogix Gateway Configuration Tool (1756-GTWY) to set-up a routing table for the 1756-DHRIO module in ControlLogix system #2. Your table should look like this:



2. Apply the routing table to your application.

Important: Controller slot values for channels configured for DH+ should be applied or restored to default value, using the appropriate software tabs.

In this example, controller values do not matter, but failure to enter a value, specific or default, will generate a configuration fault for that channel.

For more information . . .

For more information on how to set-up a routing table using the ControlLogix Gateway Configuration Tool (1756-GTWY), see publication 1756-6.5.7.

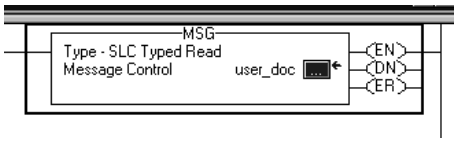
3 **Configure Msg Instructions**

See Logix5550 Instruction Set Reference, publication 1756-6.4.1

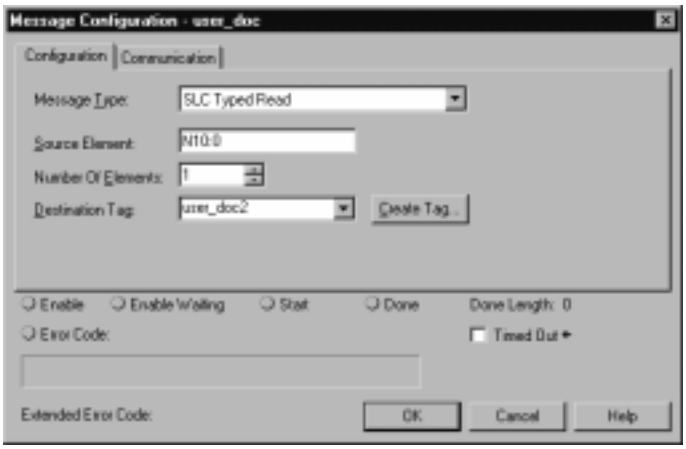
Configure Message Instructions

You must use RSLogix5000 to configure the Logix5550 message instructions.

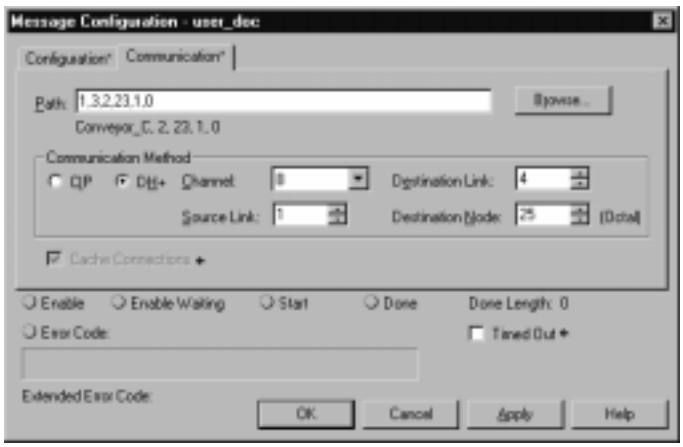
Ladder rung



Configuration page



Communication page



When using DH+ messaging from a Logix5550, the path is the connection path from the Logix5550 to the first 1756-DHRIO module. For more information on connection paths, see chapter 4.

For more information on how to configure message instructions using the RSLogix5000 software, see the online help for that software.

Chapter Summary and What's Next

In this chapter, you learned about Logix5550 to PLC-5 or SLC-5/04 messaging.

Move on to Chapter 8 to learn about Logix5550 to Logix5550 messaging.

Logix5550 to Logix5550 Messaging

What This Chapter Contains

This chapter describes how to use Control and Information Protocol (CIP) messaging between Logix5550s with the 1756-DHRIO module. The following table describes what this chapter contains and its location.

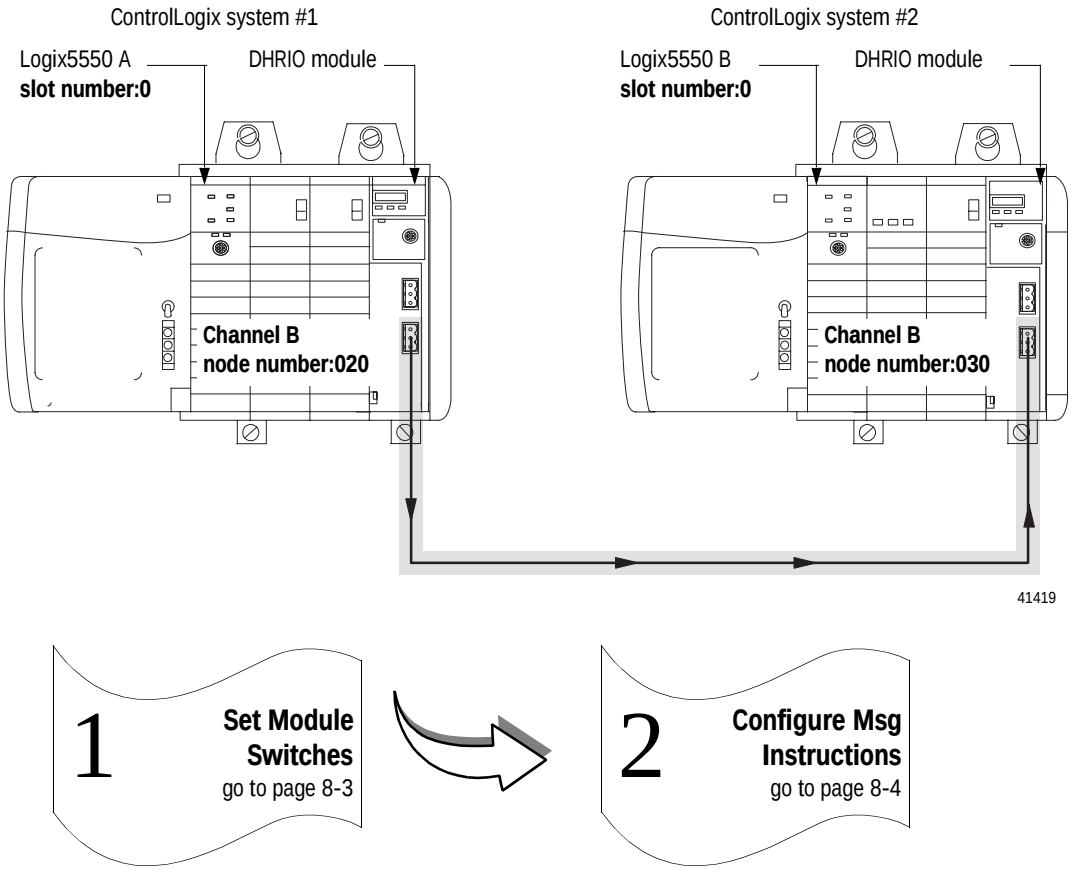
For information about using:	See page:
CIP Messaging Between a Logix5550 and a Logix5550 Over One Link	8-2
CIP Messaging Between a Logix5550 and a Logix5550 Over Two Links	8-5
Chapter Summary and What's Next	8-8

This chapter contains two example applications. Each example explains what steps must be taken to perform these operations.

CIP Messaging Between a Logix5550 and a Logix5550 Over One Link

This application sends a CIP message from Logix5550 A through a 1756-DHRIO module to Logix5550 B processor B on a DH+ link.

The following diagram illustrates the steps you follow to use such an application:



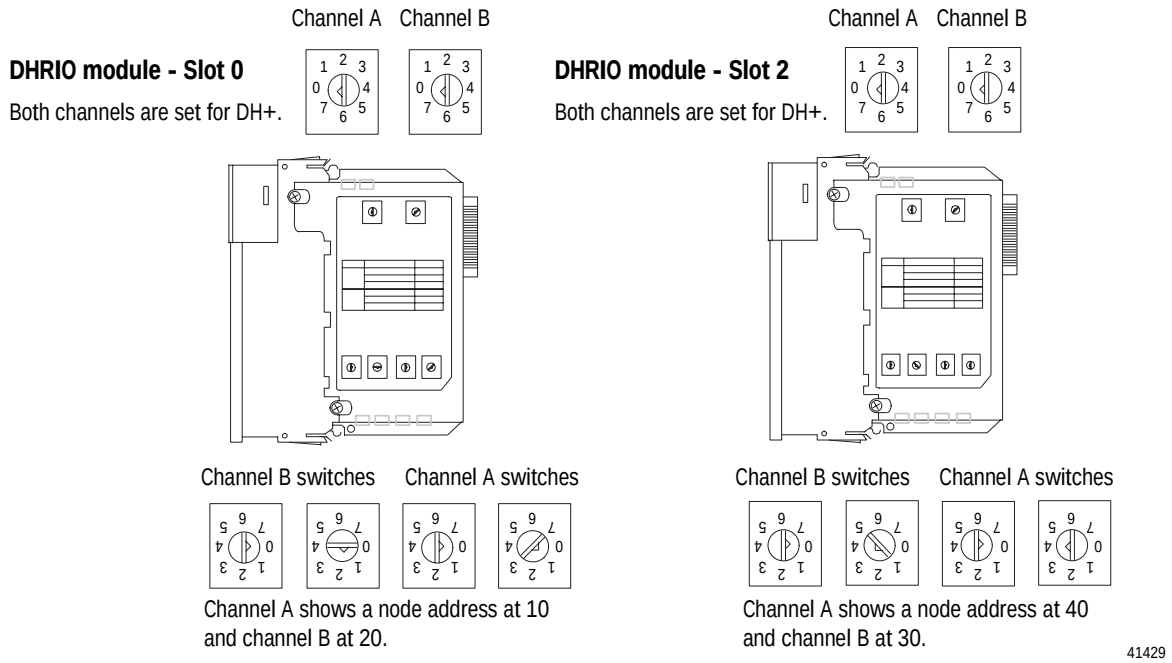
1 **Set Module Switches**

See setting switches 1-5

Set the Module Switches

In this application, Channel B on both 1756-DHRIO modules must be set for DH+.

Set the switches as shown below.



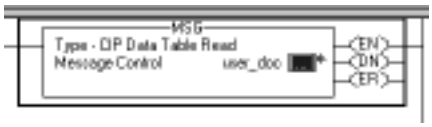
2 **Configure Msg Instructions**

See Logix5550 Instruction Set Reference, publication 1756-6.4.1

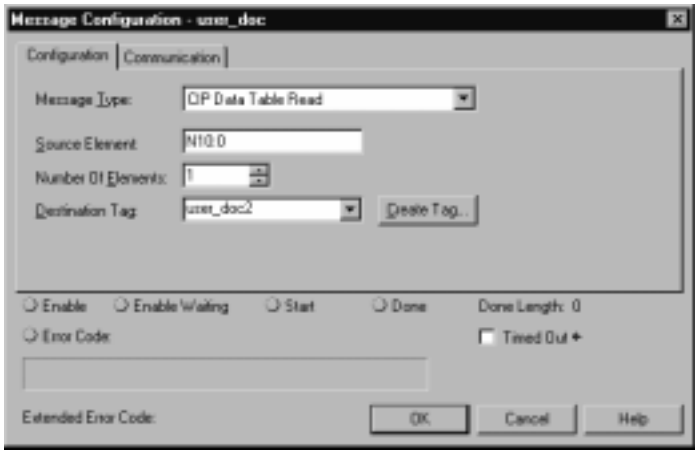
Configure Message Instructions

You must use RSLogix5000 to configure the Logix5550 message instructions.

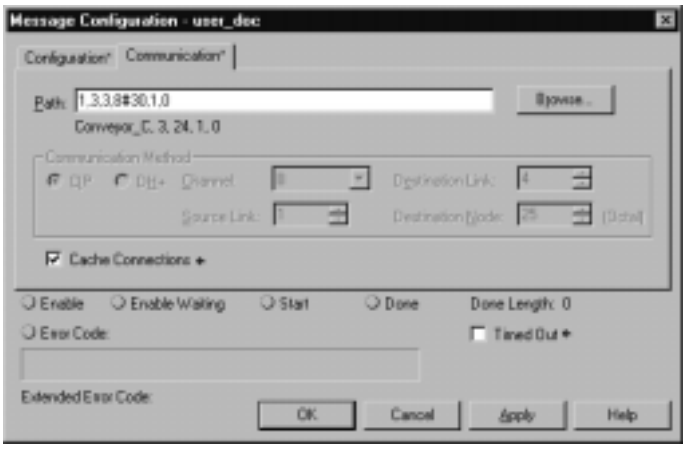
Ladder rung



Configuration page



Communication page



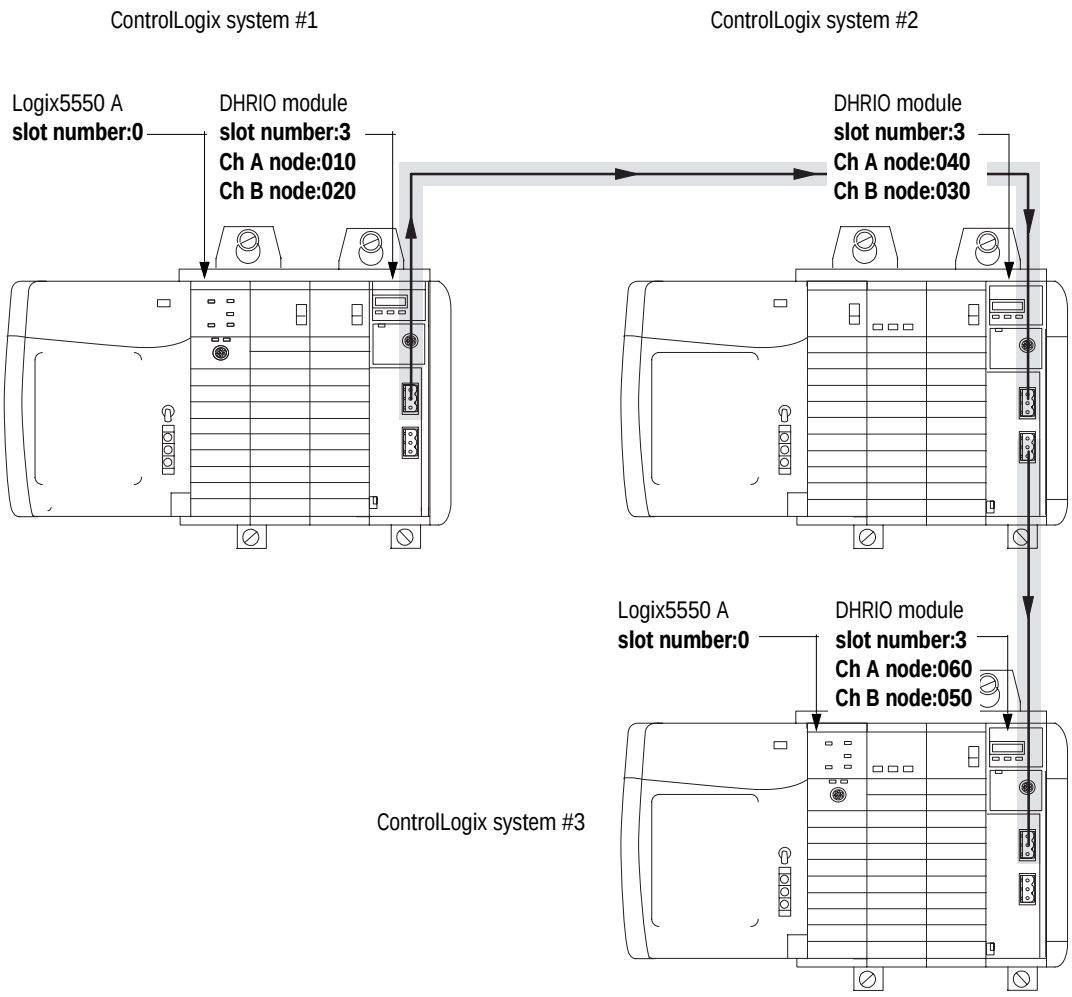
When using CIP messaging from a Logix5550, the path is the connection path from the Logix5550 to the final target of the message. For more information on connection paths, see chapter 4.

For more information on how to configure message instructions using the RSLogix5000 software, see the online help for that software.

CIP Message Routing Between a Logix5550 and a Logix5550 Over Two Links

This application sends a CIP message from Logix5550 A through a 1756-DHRIO module to Logix5550 B processor B over two links.

The following diagram illustrates the steps you follow to use such an application:



1 **Set Module Switches**
go to page 8-6

2 **Configure Msg Instructions**
go to page 8-7

1 **Set Module Switches**

See setting switches 1-5

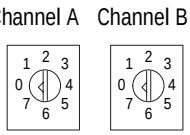
Set the Module Switches

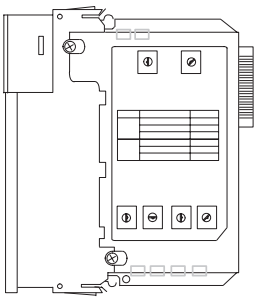
In this application, Channel A on the first and last 1756-DHRIO modules must be set for DH+. Channel A and B on the second 1756-DHRIO module must both be set for DH+.

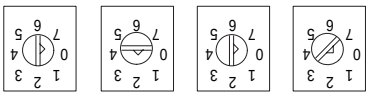
Set the switches as shown below.

DHRIO module -Chassis 1
Slot 3

Both channels are set for DH+.



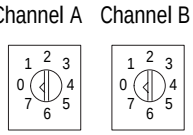


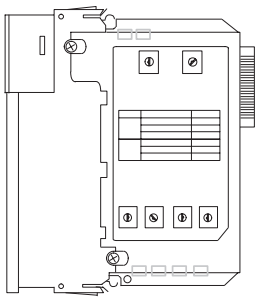


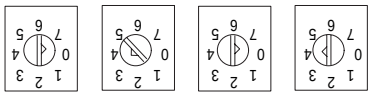
Channel A shows a node address at 10 and channel B at 20.

DHRIO module -Chassis 2
Slot 3

Both channels are set for DH+.



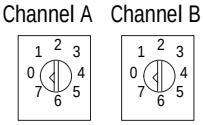


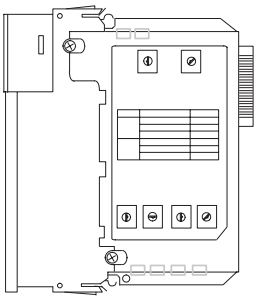


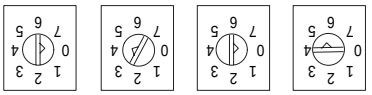
Channel A shows a node address at 40 and channel B at 30.

DHRIO module -Chassis 3
Slot 3

Both channels are set for DH+.







Channel A shows a node address at 60 and channel B at 50.

41427

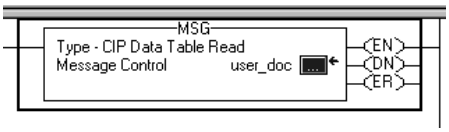
2 **Configure Msg Instructions**

See Logix5550 Instruction Set Reference, publication 1756-6.4.1

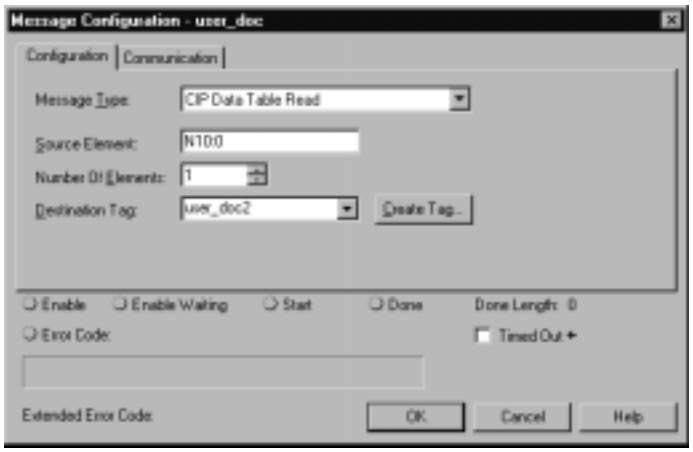
Configure Message Instructions

You must use RSLogix5000 to configure the Logix5550 message instructions.

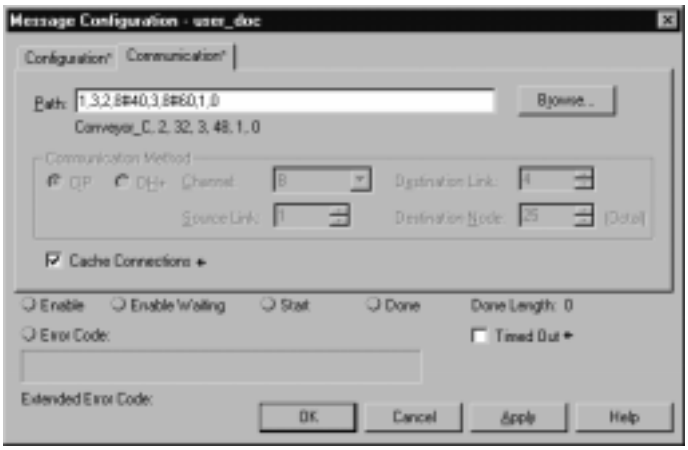
Ladder rung



Configuration page



Communication page



When using CIP messaging from a Logix5550, the path is the connection path from the Logix5550 to the final target of the message. For more information on connection paths, see chapter 4.

For more information on how to configure message instructions using the RSLogix5000 software, see the online help for that software.

Chapter Summary and What's Next

In this chapter, you learned about Logix5550 to Logix5550 messaging.

Move on to Chapter 9 to learn about the basics of remote I/O.

Basics of Using Remote I/O

What This Chapter Contains

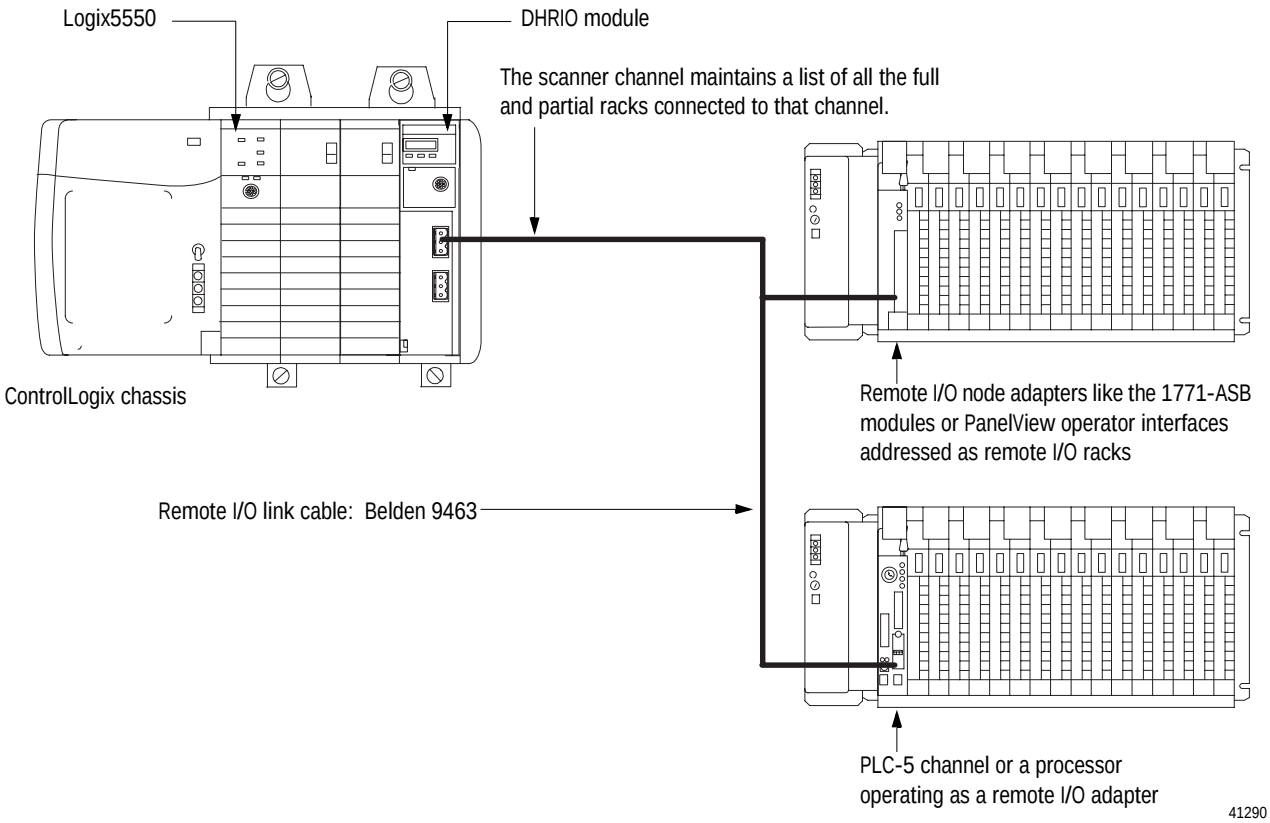
This chapter describes the basic procedures of using the 1756-DHRIO module in RIO scanner mode and configuring a remote I/O network. The following table describes what this chapter contains and its location.

For information about using:	See page:
Introduction to Remote I/O	9-1
Selecting Devices That You Can Connect	9-2
Designing a Remote I/O Network	9-3
Configuring a DHRIO Channel as a RIO Scanner	9-5
Chapter Summary and What's Next	9-6

Introduction to Remote I/O

The remote I/O system lets you control I/O that is not within the controller's chassis. A 1756-DHRIO channel, configured as an RIO scanner, transfers discrete and block-transfer data between a Logix5550 controller and remote I/O devices.

An example remote I/O system looks like this:



The remote I/O scanner channel keeps a list of all the adapters on the RIO network it transfers data with.

Follow these steps for setting up a remote I/O system:

Table 9.1
Setting Up a Remote I/O System

Step:	See:
1. configure the remote I/O adapter device	the device's user manual
2. layout and connect the remote I/O link cable	page 9-3
3. configure the scanner channel	page 9-5

Selecting Devices That You Can Connect

The following table lists some of the devices you can use on a remote I/O network as an adapter:

Table 9.2
Devices You Can Connect to a Remote I/O Link

Category:	Product:	Catalog number:
Other Processors (in adapter mode)	enhanced PLC-5 processors	1785-LxxB
	Ethernet PLC-5 processors	1785-LxxE
	ControlNet PLC-5 processor	1785-LxxC
	VMEbus PLC-5 processors	1785-VxxB
	extended-local PLC-5 processors	1785-LxxL
	classic PLC-5 processors	1785-LTx
To Remote I/O	SLC 500 Remote I/O Adapter Module	1747-ASB
	1791 Block I/O	1791 series
	Remote I/O Adapter Module	1771-ASB
	1-Slot I/O Chassis with Integral Power Supply and Adapter	1771-AM1
	2-Slot I/O Chassis with Integral Power Supply and Adapter	1771-AM2
	Direct Communication Module	1771-DCM
Operator Interfaces	DL40 Dataliner	2706-xxxx
	RediPANEL	2705-xxx
	PanelView Terminal	2711-xxx
Drives	Remote I/O Adapter for 1336 AC Industrial Drives	1336-RIO
	Remote I/O Adapter for 1395 AC Industrial Drives	1395-NA

Designing a Remote I/O Network

Designing a remote I/O network requires applying:

- remote I/O network design guidelines
- cable design guidelines

Network Design Guidelines

Keep these rules in mind as you design remote I/O network:

- All devices connected to a remote I/O network must communicate using the same communication rate, 57.6, 115.2, or 230.4kbps.
- One or both channels of the 1756-DHRIO module in scanner mode cannot scan the same partial or full rack address. Assign unique partial and full racks to each channel used in remote I/O scanner mode.
- A channel can have a maximum of 32 rack numbers and a maximum of 32 physical devices connected to it.

Important: When both channels on the 1756-DHRIO module are configured for RIO, each channel must be connected to adapters with unique rack numbers. For example, channel A communicates to 00-37 octal and channel B communicates to 40-77 octal)

Cable Design Guidelines

Specify 1770-CD (Belden 9463) cable. Connect a remote I/O network using a daisy chain or trunk line/drop line configuration.

Trunk line/drop line considerations:

When using a trunk line/drop line configuration, use 1770-SC station connectors and follow these cable-length guidelines:

- trunk line-cable length—depends on the communication rate of the link
- drop-cable length—30.4 m (100 cable-ft.)

For more information about designing trunk line/drop line configurations, see the Data Highway/Data Highway Plus/Data Highway II/Data Highway-485 Cable Installation Manual, publication 1770-6.2.2.

Verify that your system's design plans specify cable lengths within allowable measurements.

Important: The maximum cable length for remote I/O depends on the transmission rate. Configure all devices on a remote I/O network to communicate at the same transmission rate.

For daisy chain configurations, use this table to determine the total cable length you can use.

Table 9.3
Determining Cable Length

A remote I/O network using this communication rate:	Cannot exceed this cable length:
57.6 kbps	3,048m (10,000 ft)
115.2 kbps	1,524m (5,000 ft)
230.4 kbps	762m (2,500 ft)

For proper operation, terminate **both** ends of a remote I/O network by using the external resistors shipped with the 1756-DHRIO module. Selecting either a 150Ω or a 82Ω terminator determines how many devices you can connect on a single remote I/O network.

Table 9.4
Determining Resistor Rating and the Number of Devices Connected on Your Network

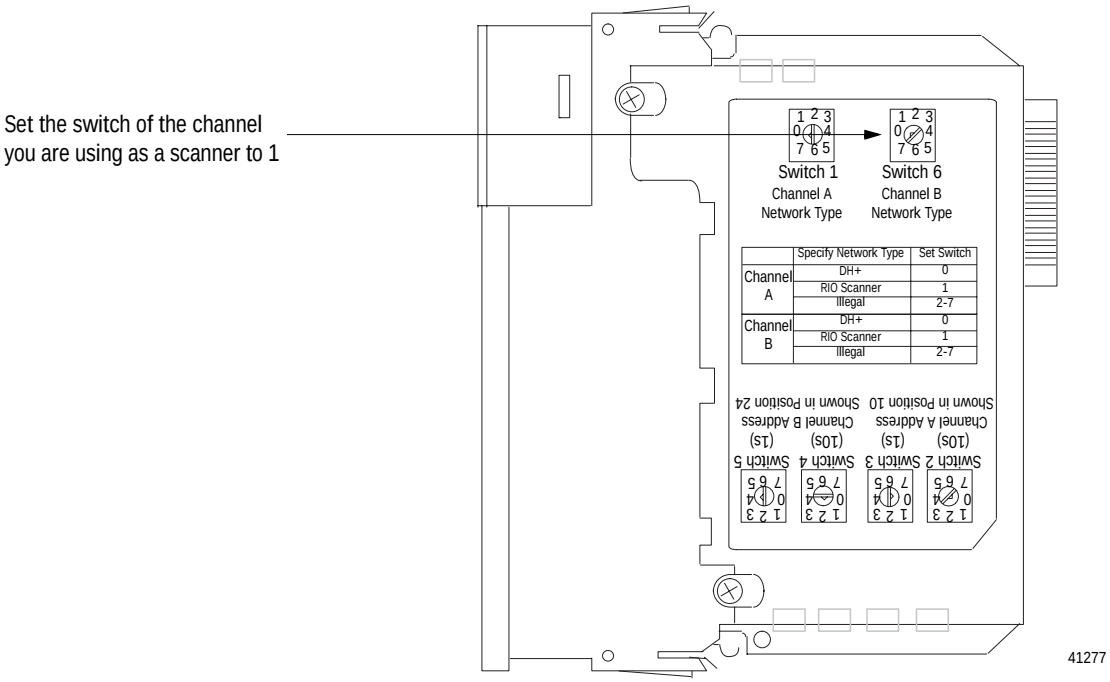
If your remote I/O network:	Use this resistor rating:	The maximum number of physical devices you can connect on the network:	The maximum number of racks you can scan on the network:
operates at 230.4 kbps	82Ω	32	32
operates at 57.6 kbps or 115.2 kpbs and no devices listed in the table below are on the network			
contains any device listed in the table below	150Ω	16	16
operates at 57.6 kbps or 115.2 kbps, and you do not require the network to support more than 16 physical devices			

Table 9.5
I/O Adapter Devices that Require 150Ω Termination Resistors

Device Type:	Catalog Number:	Series:
Adapters	1771-AS	All
	1771-ASB	
	1771-DCM	
Miscellaneous	1771-AF	

Configuring a DHRIO Channel as a RIO Scanner

When you are using a DHRIO channel as a scanner, you must set the rotary switch on the module to identify RIO functionality. Use the diagram below to determine how to set the switches.



Important: If you require a channel to be configured for DH+, use Channel A. By doing so, you can connect your programming terminal to the connector on the front of the module and communicate to devices on the network.

If only one channel is needed for RIO, use Channel B.

Chapter Summary and What's Next

In this chapter, you learned about the basics of using remote I/O

Move on to Chapter 10 to learn about remote I/O operation.

Remote I/O Operation

What This Chapter Contains

This chapter describes how to communicate with remote I/O. The following table describes what this chapter contains and its location.

For information about using:	See page:
DHRIO Module Operation	10-1
RIO Scanner Status	10-3
Setting the Rate of Data Exchange Between the Logix5550 and the 1756-DHRIO Module	10-4
RIO Scanner Status Update Rate With the 1756-DHRIO Module in a Local Chassis	10-4
RIO Scanner Status Update Rate With the 1756-DHRIO Module in a Remote Chassis	10-4
DHRIO System Failure Notification and Update Rate	10-7
RIO Scanner Failure Notification and Update Rates	10-9
Inhibiting the DHRIO and RIO Rack Connections	10-10
Inhibiting an RIO Connector Adapter	10-10
Increased Remote I/O System Throughput	10-11
Sending Block Transfer Data	10-12
Block Transfer Notification	10-12
Block Transfer 'Pass-Through' Messages	10-13
Troubleshooting Remote I/O Communication Difficulties	10-14
Chapter Summary and What's Next	10-16

DHRIO Module Operation

The 1756-DHRIO module provides two configurable channels that can either send and receive messages over DH+ or scan remote I/O devices. When a channel is configured for remote I/O, the 1756-DHRIO module is designed to function as an RIO scanner for a Logix5550 controller.

When a 1756-DHRIO module is functioning as an RIO scanner, the following occurs:

- I/O data is exchanged between the 1756-DHRIO module and remote I/O adapters on the RIO link
- I/O data is exchanged between the 1756-DHRIO module and the Logix5550 controller

Exchanging I/O Data Between Adapters on the RIO Link and the 1756-DHRIO Module

I/O data is exchanged between adapters on the RIO link and the 1756-DHRIO module based on a list of adapters generated in the I/O configuration tree in the Controller Organizer of RSLogix 5000.

The Logix5550 controller, known as the owner-controller, downloads this list, along with the RIO baud rate, to the 1756-DHRIO module. This completes the configuration of the remote I/O on the 1756-DHRIO module.

The remote I/O network pre-dates the producer/consumer model used for ControlLogix. Therefore, the 1756-DHRIO does not use producer/consumer on the remote I/O network. Instead, the 1756-DHRIO module scans each adapter (exchange I/O data) in the list as quickly as possible.

Exchanging I/O Data Between the Logix5550 and the 1756-DHRIO Module

I/O data and status are exchanged between the Logix5550 and the 1756-DHRIO module through the producer/consumer model used by the ControlLogix system.

Multiple connections are established between the Logix5550 and the 1756-DHRIO module. These connections can be classified in two categories. In the first category, connections are established between the Logix5550 and the 1756-DHRIO module for each adapter on the remote I/O link. I/O data is exchanged on these connections.

In the second category, a connection is established between the Logix5550 and the supervisor of the remote I/O on the 1756-DHRIO module. (The supervisor is the RIO scanner located internally on the module.) RIO scanner status is exchanged on this connection. In this case, the data exchange is bidirectional. The 1756-DHRIO module reports status on the RIO scanner, and the Logix5550 maintains ownership of the 1756-DHRIO module.

Important: Only 1 Logix5550 controller can communicate and own the RIO channels on a 1756-DHRIO module.

I/O Configuration Tree in Controller Organizer in RSLogix 5000

The I/O configuration tree in the Controller Organizer in RSLogix 5000 specifies the connections to the 1756-DHRIO module, in addition to generating the adapter list of the 1756-DHRIO module to scan.

The entry of a 1756-DHRIO module in the I/O configuration tree of the Controller Organizer specifies the status connection between the Logix5550 and the scanner function on the 1756-DHRIO module.

The entries of adapters under the 1756-DHRIO module in the I/O configuration tree of the Controller Organizer specifies the connections between the Logix5550 and the 1756-DHRIO module for each adapter's data.

Only enter a 1756-DHRIO module into the I/O configuration tree of the Controller Organizer if at least one of the module's channels is configured for remote I/O.

RIO Scanner Status

A connection is used to exchange remote I/O scanner status as described above. The data from the 1756-DHRIO module contains the current state of the channels (A/B) that are configured for remote I/O. The data from the Logix5550 represents an update used by the 1756-DHRIO module to maintain ownership.

This data exchange is continually updated and is responsible for maintaining module awareness in the system.

Adapter Module I/O

The 1756-DHRIO module scans the remote I/O devices as they appear in the Logix5550's controller organizer. The entries in the organizer represent logical adapters. The physical adapter modules on RIO may act as several racks. This depends on the addressing mode of the physical adapter and chassis.

The RSLogix 5000 software allows 4 choices for the adapter modules:

- 1747 Remote I/O adapter
- 1771 Remote I/O adapter
- 1794 Remote I/O adapter
- Generic Remote I/O adapter

Each entry includes the following:

- rack address - values are 00-77 octal
- starting group - can start in slot 0, 2, 4, or 6
- rack size - can be 1/4, 1/2, 3/4 or full rack

Important: Each choice provides a way of determining what type of adapter is present on the RIO network. They all behave the same in the ControlLogix system. When online, the 1756-DHRIO module cannot tell which specific adapter is connected to the RIO network.

The adapter output data sent by the Logix5550 is consumed by the 1756-DHRIO module on the connection created when you add remote I/O devices in RSLogix 5000.

The output data is produced by the owner-controller at the RPI and is not tied to the scan time of the controller's program. How often the output data is sent by the RIO scanner to the RIO adapters depends upon the number of adapters on the channel and the baud rate used.

The rack input data received in the adapter response is produced by the 1756-DHRIO module immediately after the RIO adapter response is received. The owner-controller receives the data directly into the data buffer created by the software. The frequency at which the input data is produced depends upon the number of adapters on the channel and the baud rate used.

Setting the Rate of Data Exchange Between the Logix5550 and the 1756-DHRIO Module

The following sections describe the process of setting the Requested Packet Interval (RPI) for data exchanges between the Logix5550 and the 1756-DHRIO module. An RPI must be set for both the remote I/O scanner status connection and each adapter connection.

Requested Packet Interval (RPI)

This interval specifies the rate at which the 1756-DHRIO module and the Logix5550 produce data. The time ranges from 3mS to 750mS and is sent to the module with all other configuration parameters. When the specified timeframe elapses, the 1756-DHRIO module and the Logix5550 will produce data for each other.

RIO Scanner Status Update Rate With the 1756-DHRIO in a Local Chassis

When a module resides in the same chassis as the owner controller, the RPI affects how and when the module produces link status and consumes the controller status.

The rate the status is exchanged at is equal to the RPI.

RIO Scanner Status Update Rate With the 1756-DHRIO Module in a Remote Chassis

If a module physically resides in a chassis other than where its owner-controller is (i.e. a remote chassis connected via ControlNet), the rate the status is exchanged at is equal to the RPI + 2 x [Network Update Time (NUT)].

TIP

To maximize notification of the module status, we recommend setting the 1756-DHRIO module's RPI value equal to the RPI used in the adapter connections.

Setting the Rate of I/O Data Exchange Between the Logix5550 and the 1756-DHRIO Module

The rate of I/O data exchange is directly related to the configured RIO scanner baud rate. Your 1756-DHRIO module allows the following baud rates:

- 57.6Kbaud
- 115.2Kbaud
- 230.4Kbaud

The RIO scanner scan each RIO adapter at the following rates:

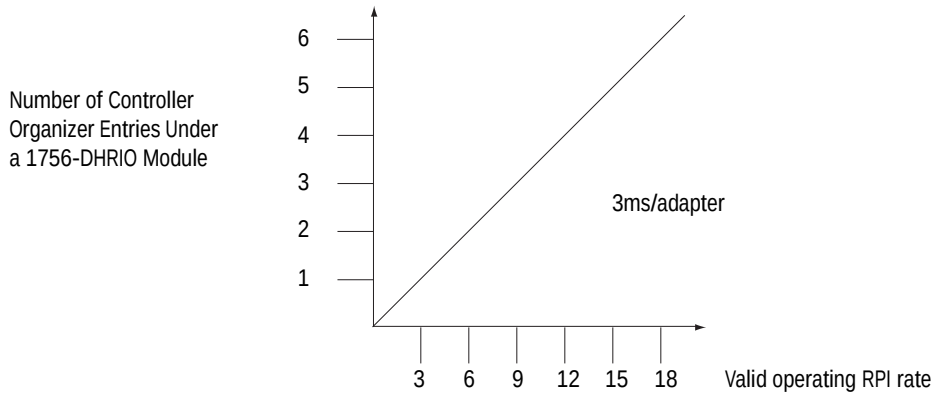
- 8ms/adapter @ 57.6Kbaud
- 5ms/adapter @ 115.2Kbaud
- 3ms/adapter @ 230.4Kbaud

To determine the RPI for all Controller Organizer entries use graphs on the following page.

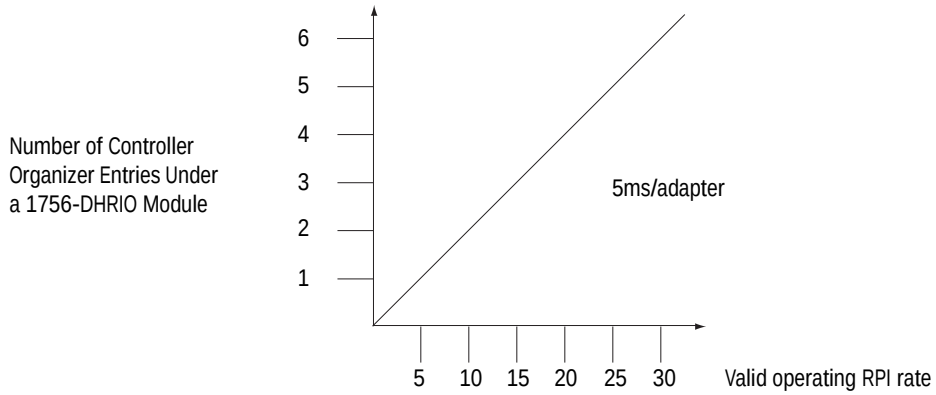
Minimum Requested Packet Intervals (RPIs)

The tables below provide the minimum RPI for the different baud rates. Rates faster than those specified do not provide greater data throughput.

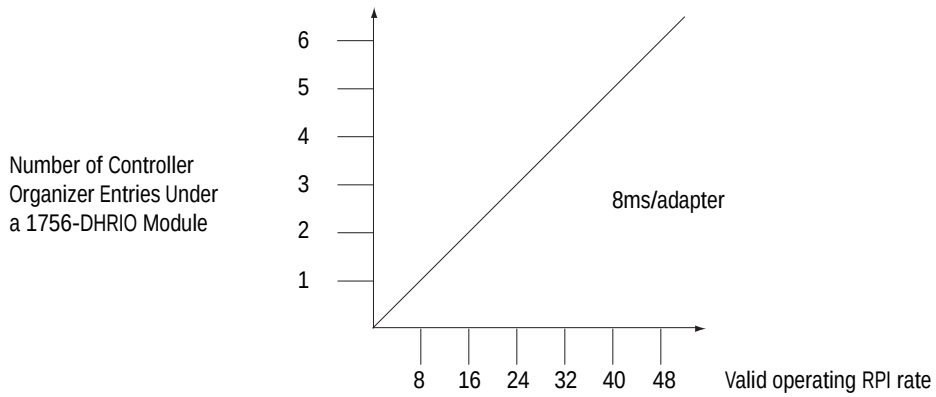
Adapter Update Rates for RIO at 230.4Kbaud Rate



Adapter Update Rates for RIO at 115.2Kbaud Rate



Adapter Update Rates for RIO at 57.6Kbaud Rate



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Adapter Module I/O Update Rate with the 1756-DHRIO Module in the Local Chassis

When the 1756-DHRIO module resides in the same chassis as the owner-controller, updated output data (refreshed to new values via the control program) is delivered to the adapter module at:

*RPI + scan rate per adapter * number of adapters*

Where the RPI is equal to the value determined from the graphs on page 10-6, and scan rate per adapter=3ms @ 230.4K, 5ms @115.2K, or 8ms @57.6K.

The updated input data is delivered to the Logix5550 at:

*Scan rate per adapter * number of adapters*

The update rate for an adapter module (i.e. the rate at which I/O data is produced/consumed between the owner-controller and the 1756-DHRIO module) is:

*RPI + 2[Scan rate per adapter * number of adapters]*

This is a turnaround calculation for an output to input in the same rack.

When you include block transfers, the update rate for an adapter module is:

*RPI + 2(Scan rate per adapter * number of adapters) + (Scan rate per adapter * total number of adapters with BT modules in them)*

Adapter Module I/O Update Rate with the 1756-DHRIO Module in the Remote Chassis

When the 1756-DHRIO module resides in the remote chassis from the owner-controller, updated output data (refreshed to new values via the control program) is delivered to the adapter module at:

*RPI + (scan rate per adapter * number of adapters) + 2(NUT)*

The updated input data is delivered to the Logix5550 at:

*(scan rate per adapter * number of adapters) + 2(NUT)*

The update rate for an adapter module (i.e. the rate at which I/O data is produced/consumed between the owner-controller and the 1756-DHRIO module) is:

*RPI + 2(scan rate per adapter * number of adapters) + 4(NUT)*

This is a turnaround calculation for an output to input in the same rack.

When you include block transfers, the update rate for an adapter module is:

*RPI + 2(scan rate per adapter * number of adapters) + (Scan rate per adapter * total number of adapters with BT modules in them) + 4(NUT)*

RIO Scanner Failure Notification

A 1756-DHRIO module using one of its channels for remote I/O has a connection open between the module and its owner-controller. The RIO scanner status is continually being exchanged over this connection. This continuous data exchange is responsible for maintaining module awareness in the system.

If at any time this continuous data exchange is interrupted for a time that is 4 times the RPI, the Logix5550 drops the current RIO scanner configuration and terminates communication with the adapters on the RIO network. The channel configured for RIO scanner goes offline and waits for new configuration data before beginning communication with the RIO network.

The Logix5550 also performs one of the following scenarios:

- Logix5550 will fault, if the 1756-DHRIO module has been configured for a major fault to occur on the controller if communication fails.
- Logix5550 will not fault, if the 1756-DHRIO module has not been configured for a major fault to occur if communication fails. In this case, the Logix5550 will repeatedly attempt to reestablish communications with the 1756-DHRIO module.

The update rate for the data exchange should be set to go at the minimum RPI set for the data flow between the Logix5550 and the RIO adapters. This guarantees the scanner will quickly terminate remote I/O network communications if the 1756-DHRIO module loses data flow from the Logix5550.

RIO Adapter Failure Notification

The speed at which the Logix5550 is notified that a remote I/O adapter has faulted is directly related to the RPI. The fault, known as a connection timeout, will occur at 4 times the RPI. For example, if the RPI is set at 25ms and a fault occurs, the Logix5550 will not be notified for 100ms. For more information on connection timeouts, see page 3-11.

An RIO adapter fault notification occurs whenever the communication between the RIO scanner (Channel A or B) and a remote I/O adapter is interrupted or the communication between the 1756-DHRIO module and the Logix5550 is interrupted.

RSLogix 5000 alerts you to a rack fault in at least one of the following ways:

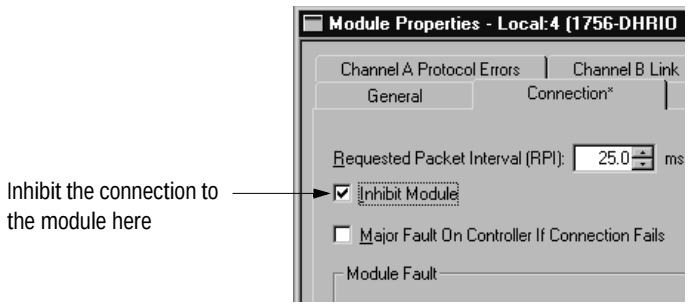
- nonzero condition appears in the tag editor
- fault icon appears in the controller organizer
- connections page displays the fault type

Inhibiting the 1756-DHRIO Module Connections

When the inhibit bit is set for the 1756-DHRIO module, the connection between the Logix5550 and the 1756-DHRIO module is terminated.

Although the 1756-DHRIO module connection is inhibited, the DHRIO scanner (Channel A or B) changes to program mode and continues to scan the RIO adapters on the RIO network. When inhibited, a 1756-DHRIO module will accept configuration from any Logix5550 in the control system.

The 1756-DHRIO connection can be inhibited on the module properties connection tab of RSLogix5000, as shown below.

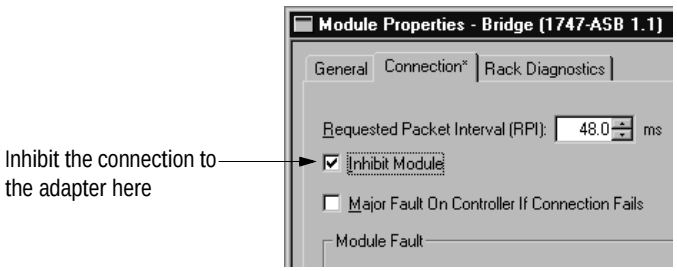


Inhibiting an RIO Connector Adapter

When the inhibit bit is set for a RIO adapter connection, the connection between the Logix5550 and the RIO adapter is terminated.

In this case, the DHRIO scanner (Channel A or B) continues to scan the RIO rack on the RIO network and switches the affected chassis of I/O into program mode. Only the Logix5550 that initiated the configuration of the 1756-DHRIO module can reestablish communications with the inhibited RIO adapter.

RIO rack connections can be inhibited on the module properties connection screen of RSLogix 5000, as shown below.



Increased Remote I/O System Throughput

Because of the unique design of the 1756-DHRIO module system, performance is greatly enhanced by splitting the RIO adapters across both channels. An example of a simple system has the following devices:

- Rack 1 - Starting Quarter 0 - Size Full
- Rack 2 - Starting Quarter 0 - Size Full

If both racks are placed on the same channel at a baud rate of 230.4Kbaud, the minimum RPI between the 1756-DHRIO module and the RIO adapters would be 6mS. If the racks are split between channel A and channel B, the update rate can be decreased to 4.5mS.

The following algorithms are used to calculate various update rates:

- @ 230.4Kbaud
  Update Rate = 3mS*(number of racks [channel A or B]) + 1/2*3mS*(number of racks [channel A or B])
- @ 115.2Kbaud
  Update Rate = 5mS*(number of racks [channel A or B]) + 1/2*5mS*(number of racks [channel A or B])
- @ 57.6Kbaud
  Update Rate = 8mS*(number of racks [channel A or B]) + 1/2*8mS*(number of racks [channel A or B])

Sending Block Transfer Data

In addition to discrete I/O, the 1756-DHRIO module supports the sending block transfer (BT) data to the Logix5550 controller. This data exchange transfers up to 64 words of data to/from a selected I/O module.

The BT data exchange is message based. This means that a message instruction in the Ladder Logic program of the Logix5550 must be used to initiate the BT request. In the case of discrete I/O modules, simply by entering the adapter in the Logix5550 organizer, data is transferred without specific instructions required.

The process for completing block transfers on remote I/O remains consistent with all adapters products. All the remote I/O network characteristics defined for the PLC-5 remote I/O scanner are the same for the 1756-DHRIO remote I/O scanner.

Block Transfer Failure Notification

The message timeout for the BT message is fixed at 4.5 seconds. This timeout is a ControlLogix network response timeout associated with the connection established between the 1756-DHRIO module and the Logix5550 controller. There is a primary timeout for the BT response that is remote I/O network based. This timeout occurs in 4 seconds if the I/O module fails to respond to the BT message.

Block Transfer 'Pass-Through' Messages

DH+ 'Block Transfer (BT) Pass-Through' messages are specific DH+ (PCCC) messages sent to an RIO channel, where it causes an RIO Block Transfer.

To target a DH+ 'BT Pass-Through' message to an RIO channel on a 1756-DHRIO module, the final destination of the DH+ message must be the 1756-DHRIO module with the RIO channel.

In the case of Local DH+ Messaging, the bridging 1756-DHRIO module must have its default slot configured to match the location (slot) of the final destination 1756-DHRIO module (module with the RIO channel).

In the case of Remote DH+ Messaging, the destination link ID and destination node of the DH+ message must be set to the final destination 1756-DHRIO module (module with the RIO channel).

For example, if the target is an RIO channel on a 1756-DHRIO module in slot 5 of a ControlLogix chassis and remote DH+ messaging is used, the destination link ID is set to the ControlLogix chassis link ID and the remote destination node is set to 5.

Important: To send DH+ 'Pass-Through' messages to a 1756-DHRIO module, the module must be configured with a valid routing table, as described in chapter 3, even if both channels are configured for RIO.

Troubleshooting Remote I/O Communication Difficulties

The 1756-DHRIO module provides status information for both the module as a whole and each of the module's channels. This information can be accessed through RSLogix 5000.

1756-DHRIO Module Status Information

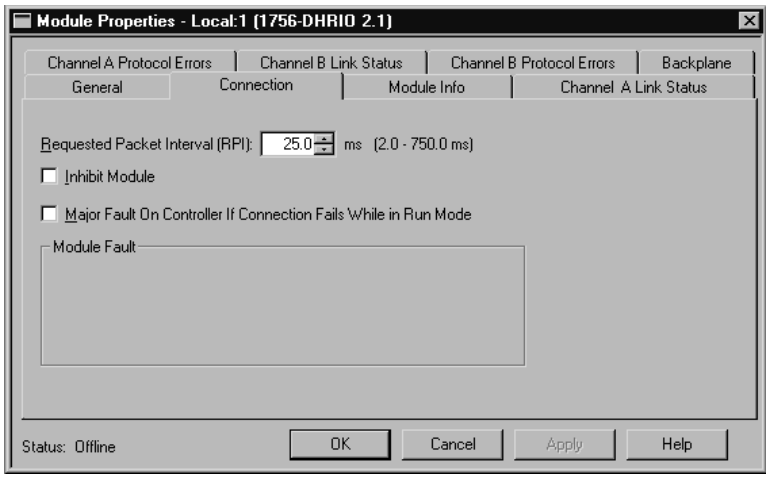
Follow these steps:

1. Right-mouse click the 1756-DHRIO module in the I/O configuration tree of the Logix5550's Controller Organizer and choose Properties from the pop-up menu, as shown below.

2. The module properties page appears in the software.

Click on the tab Connection tab or either Channel Protocol Errors tab to determine what fault/error may have occurred.

Use the on line help of RSLogix 5000 to correct the fault/error.



Remote I/O Adapter Status Information

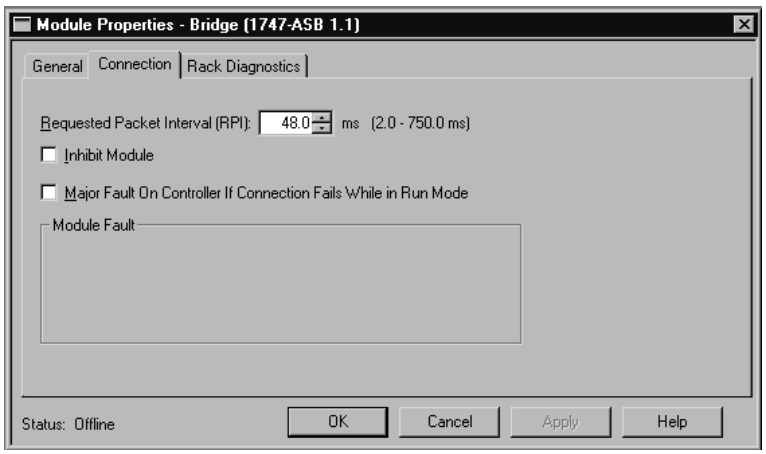
Follow these steps:

1. Right-mouse click the RIO adapter in the I/O configuration tree of the Logix5550's Controller Organizer and choose Properties from the pop-up menu, as shown below.

2. The module properties page appears in the software.

Click on the tab Connection tab or either Channel Protocol Errors tab to determine what fault/error may have occurred.

Use the on line help of RSLogix 5000 to correct the fault/error.



Chapter Summary and What's Next

In this chapter, you learned about remote I/O operation.

Move on to Chapter 11 to learn about Logix5550 and RIO Scanner System Performance Considerations.

Connecting a Logix5550 to Remote I/O

What This Chapter Contains

This chapter describes how to use the 1756-DHRIO module in RIO scanner mode to connect a Logix5550 to Remote I/O. The following table describes what this chapter contains and its location.

For information about using:	See page:
Scanning Remote FLEX Adapters Through a 1756-DHRIO Module in a Local 1756-Chassis	11-2
Scanning Remote FLEX Adapters Through Multiple 1756-DHRIO Modules in a Local Chassis	11-6
Scanning 1771 Remote I/O Adapters Through a 1756-DHRIO in a Remote Chassis	11-12
Chapter Summary and What's Next	11-18

This chapter contains three example applications. Each example explains what steps must be taken to perform these operations.

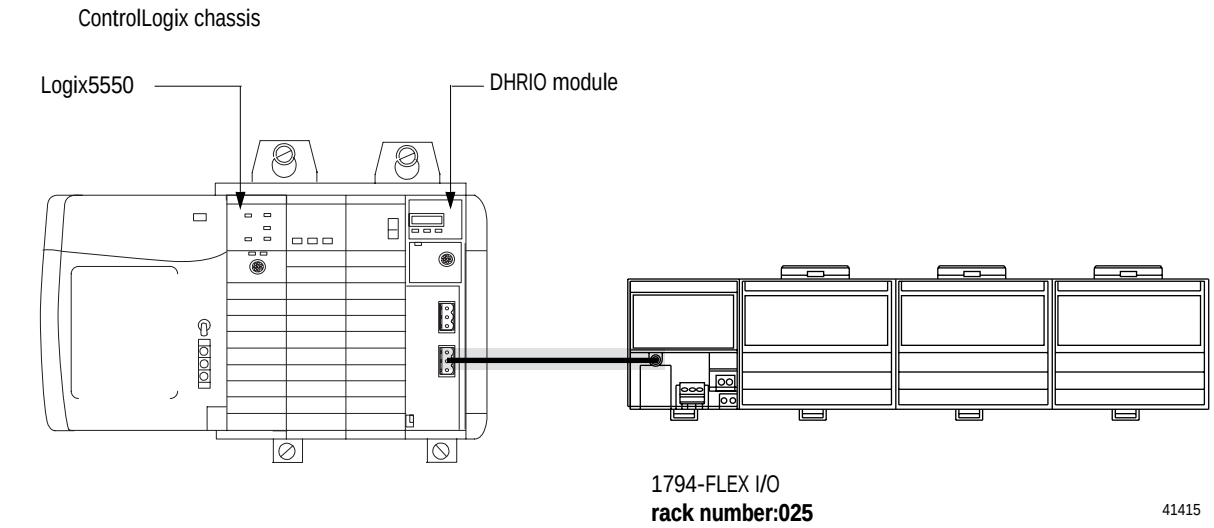
Important: In these examples, only channel B is configured as a remote I/O scanner. You can configure both channels as remote I/O scanners simultaneously if necessary.

If only one channel is configured as a remote I/O scanner, we recommend you use channel B. If you configure channel A as a remote I/O scanner, you cannot use the programming terminal on the front of the 1756-DHRIO module for DH+ access.

Scanning Remote FLEX Adapter Through a 1756-DHRIO Module in a Local 1756-Chassis

In this application, a Logix5550 controls remote I/O modules through a 1756-DHRIO module in the local chassis.

The following diagram illustrates the steps you follow to use this application:



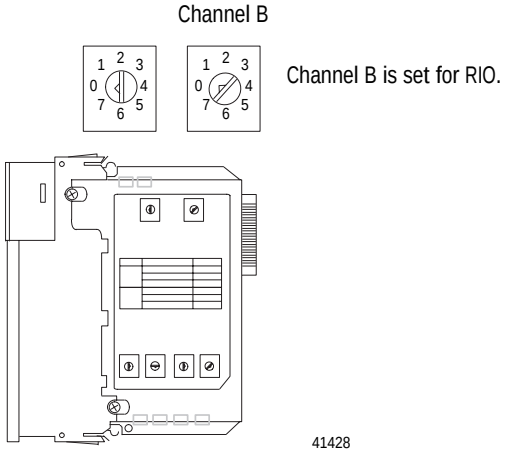
1 **Set Module Switches**

See setting switches 1-5

Set the Module Switches

In this application, channel B on the 1756-DHRIO module must be set for RIO. Channel A can be used for RIO or DH+, regardless of the usage assigned to channel B.

Set the channels as shown.

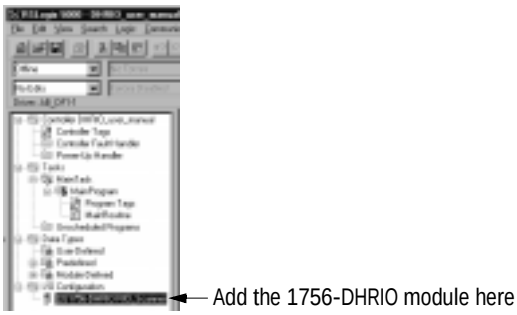


2 **Configure DHRIO Module**

Configure DHRIO Module

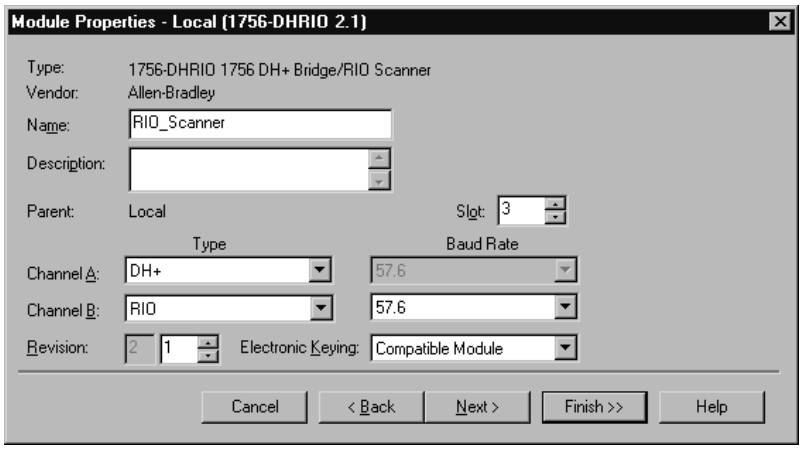
Use RSLogix5000 to configure your application. Follow these steps to configure your 1756-DHRIO module:

1. Add a 1756-DHRIO module to the Controller Organizer.



For more information about how to add modules to the Controller Organizer, see the Logix5550 User Manual, publication 1756-6.5.12.

2. Configure the 1756-DHRIO module. The following screen shows a sample configuration:



3 **Configure FLEX Adapter**

Configure the FLEX Adapter

Follow these steps to configure your 1794-ASB adapter:

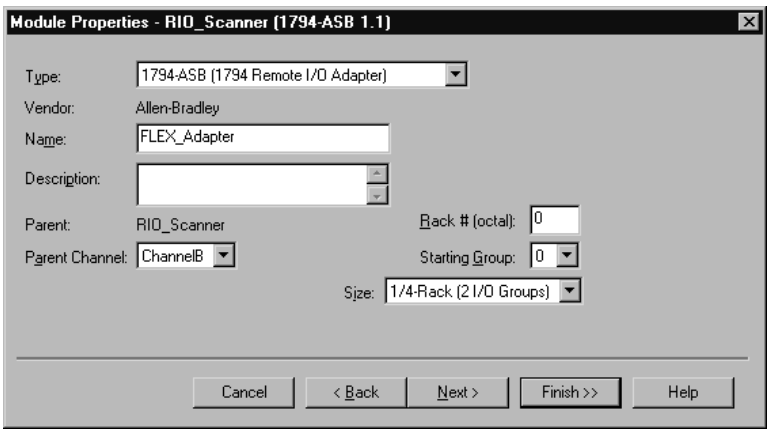
1. Add a 1794-ASB adapter under the 1756-DHRIO module entry in the Controller Organizer.

2. Configure the 1794-ASB adapter. You must fill in the following:

- **Parent channel** - select which DHRIO channel is being used to scan the FLEX I/O
- **Rack # (octal)** - indicates the RIO rack number (in octal from 0-76)
- **Size** - indicates how many words of data are available for the given rack, for example:
  1/4 rack = 2 words of input and 2 words of output
  1/2 rack = 4 words of input and 4 words of output
  3/4 rack = 6 words of input and 6 words of output
  Full rack = 8 words of input and 8 words of output
- **Starting group** - indicates that the first word of input/output from a given rack begins at either group 0, 2, 4, or 6, for example, a system of 2 racks and 4 words of I/O may be as follows:
  Rack 12, st grp 2, size 1/4
  Rack 12, st grp 6, size 1/4

Important: When you choose a starting group, remember that there is a 1 to 1 ratio of words available and words transmitted. For example, if you configure the 1794-ASB adapter for a 1/2 rack, you must specify a size equal to 1/2 rack.

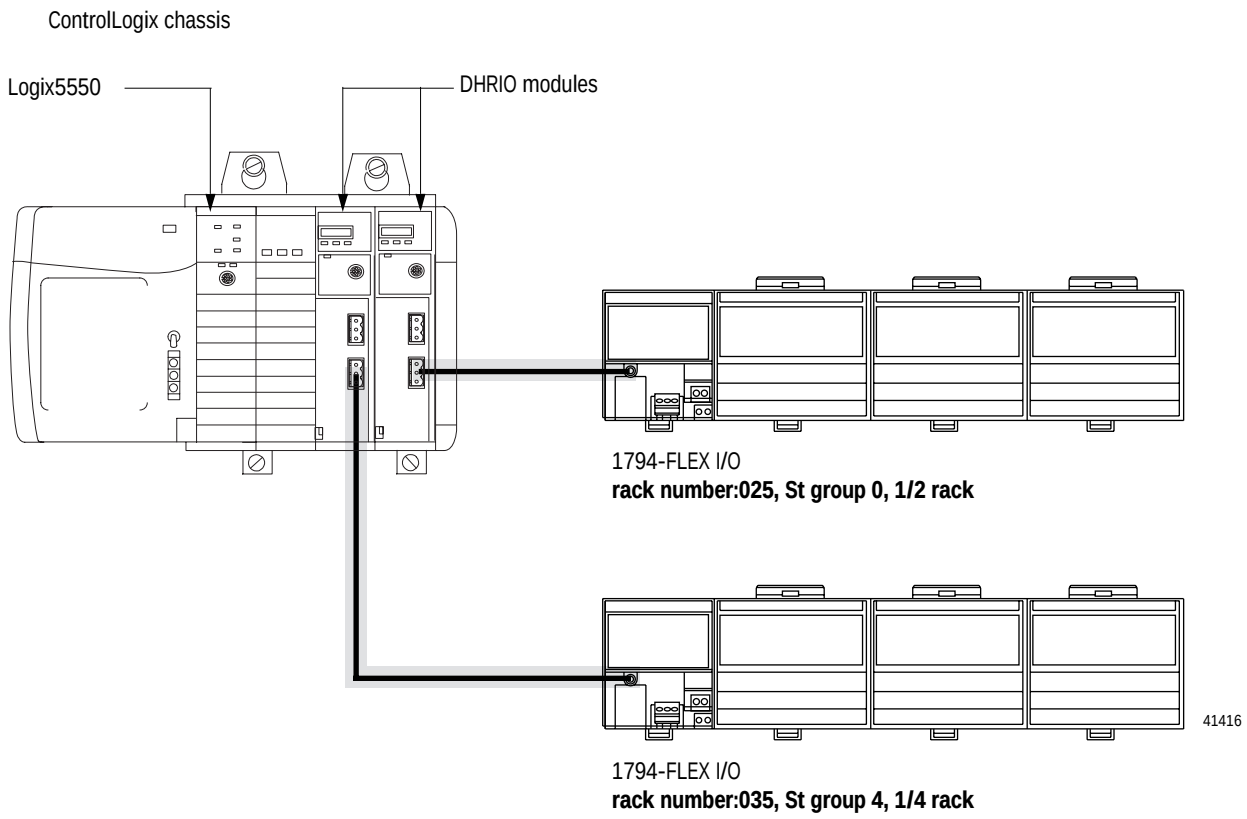
The following screen shows a sample configuration:

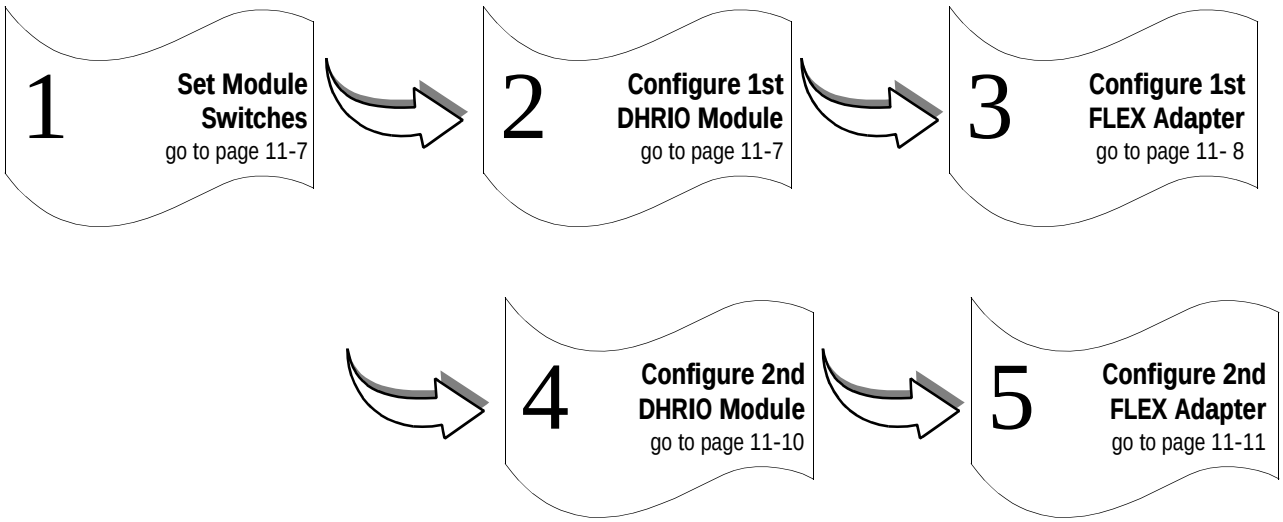


Scanning Remote FLEX Adapters Through Multiple 1756-DHRIO Modules in a Local Chassis

In this application, a Logix5550 scans multiple FLEX remote I/O adapters through multiple 1756-DHRIO modules in the local chassis.

The following diagram illustrates the steps you follow to use this application:





1 **Set Module Switches**

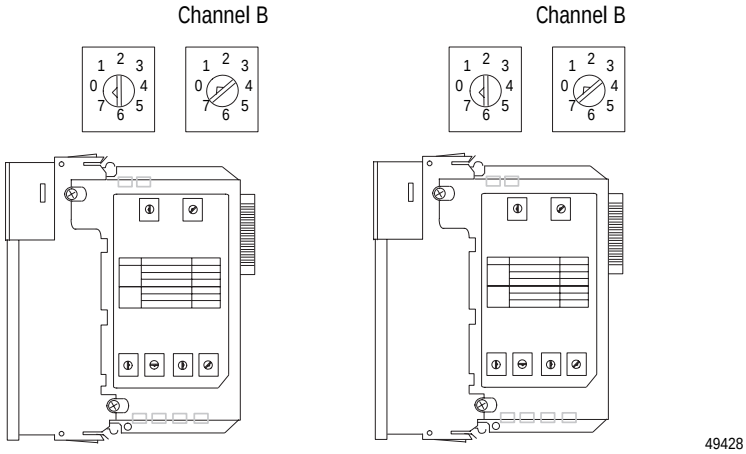
See setting switches 1-5

Set the Module Switches

In this application, channel B on the 1756-DHRIO module must be set for RIO. Channel A can be used for RIO or DH+, regardless of the usage assigned to channel B.

Set the channels as shown.

Channel B is set for RIO on both modules



2 **Configure 1st DHRIO Module**

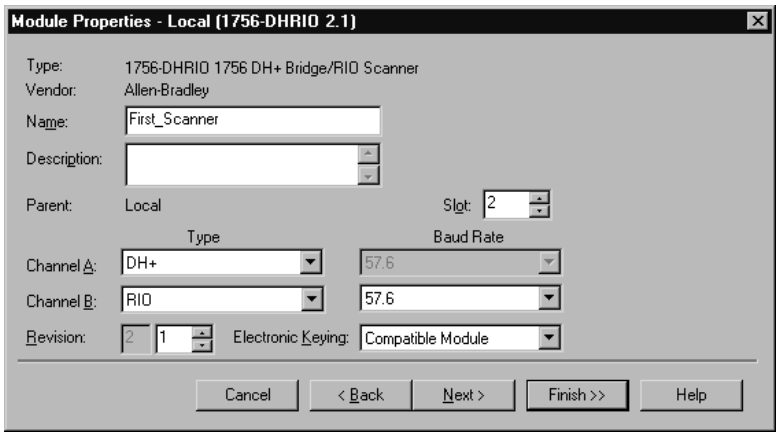
Configure 1st DHRIO Module

Use RSLogix5000 to configure your application. Follow these steps to configure the first 1756-DHRIO module:

1. Add a 1756-DHRIO module to the Controller Organizer.

For more information about how to add modules to the Controller Organizer, see the Logix5550 User Manual, publication 1756-6.5.12.

2. Configure the 1756-DHRIO module.The following screen shows a sample configuration:



3 **Configure 1st FLEX Adapter**

Configure 1st FLEX Adapter

Follow these steps to configure the first 1794-ASB adapter:

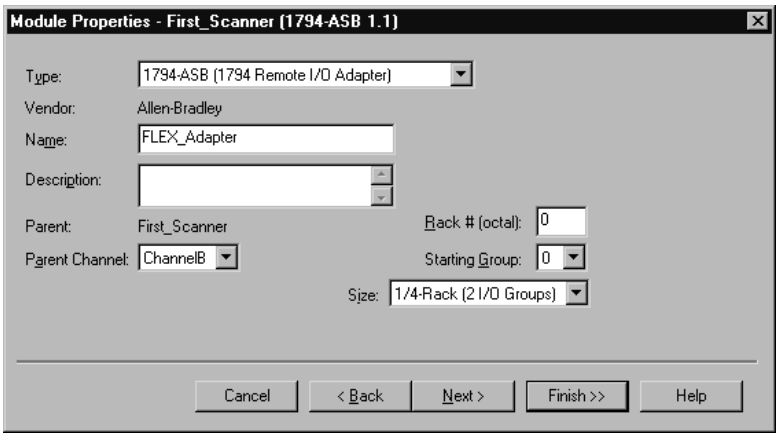
1. Add a 1794-ASB adapter under the 1756-DHRIO module entry in the Controller Organizer.

2. Configure the 1756-ASB adapter. You must fill in the following:

- **Parent channel** - select which DHRIO channel is being used to scan the FLEX I/O
- **Rack # (octal)** - indicates the RIO rack number (in octal from 0-76)
- **Size** - indicates how many words of data are available for the given rack, for example:
  1/4 rack = 2 words of input and 2 words of output
  1/2 rack = 4 words of input and 4 words of output
  3/4 rack = 6 words of input and 6 words of output
  Full rack = 8 words of input and 8 words of output
- **Starting group** - indicates that the first word of input/output from a given rack begins at either group 0, 2, 4, or 6, for example, a system of 2 racks and 4 words of I/O may be as follows:
  Rack 12, st grp 2, size 1/4
  Rack 12, st grp 6, size 1/4

Important: When you choose a starting group, remember that there is a 1 to 1 ratio of words available and words transmitted. For example, if you configure the 1756-FLEX adapter for a 1/2 rack, you must specify a size equal to 1/2 rack.

The following screen shows a sample configuration:



4 Configure 2nd DHRIO Module

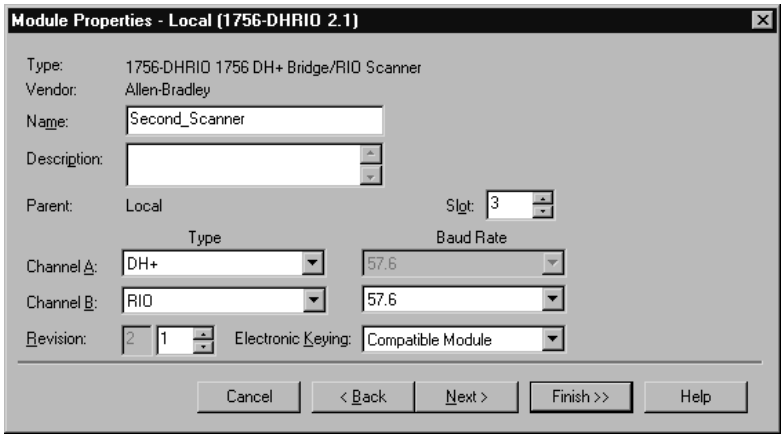
Configure 2nd DHRIO Module

Use RSLogix5000 to configure your application. Follow these steps to configure the second 1756-DHRIO module:

1. Add a 1756-DHRIO module to the Controller Organizer.

For more information about how to add modules to the Controller Organizer, see the Logix5550 User Manual, publication 1756-6.5.12.

2. Configure the 1756-DHRIO module. The following screen shows a sample configuration:



5 Configure 2nd FLEX Adapter

Configure 2nd FLEX Adapter

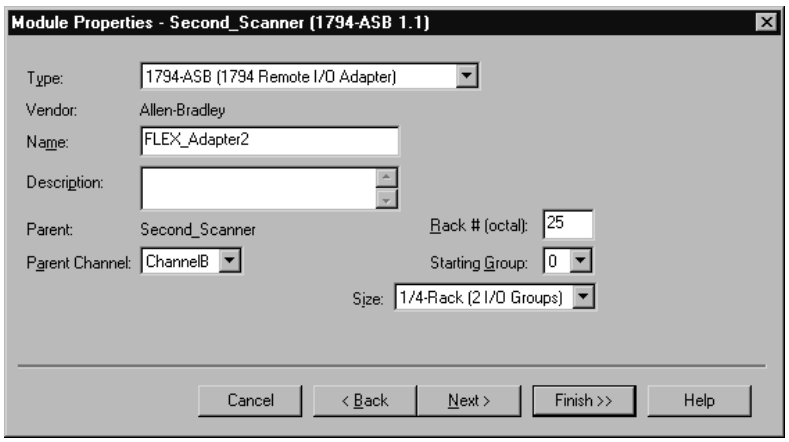
Follow these steps to configure the second 1794-ASB adapter:

1. Add a 1794-ASB adapter under the 1756-DHRIO module entry in the Controller Organizer.

2. Configure the 1794-ASB adapter. You must fill in the following:

   - **Parent channel**
   - **Rack # (octal)**
   - **Size**
   - **Starting group**

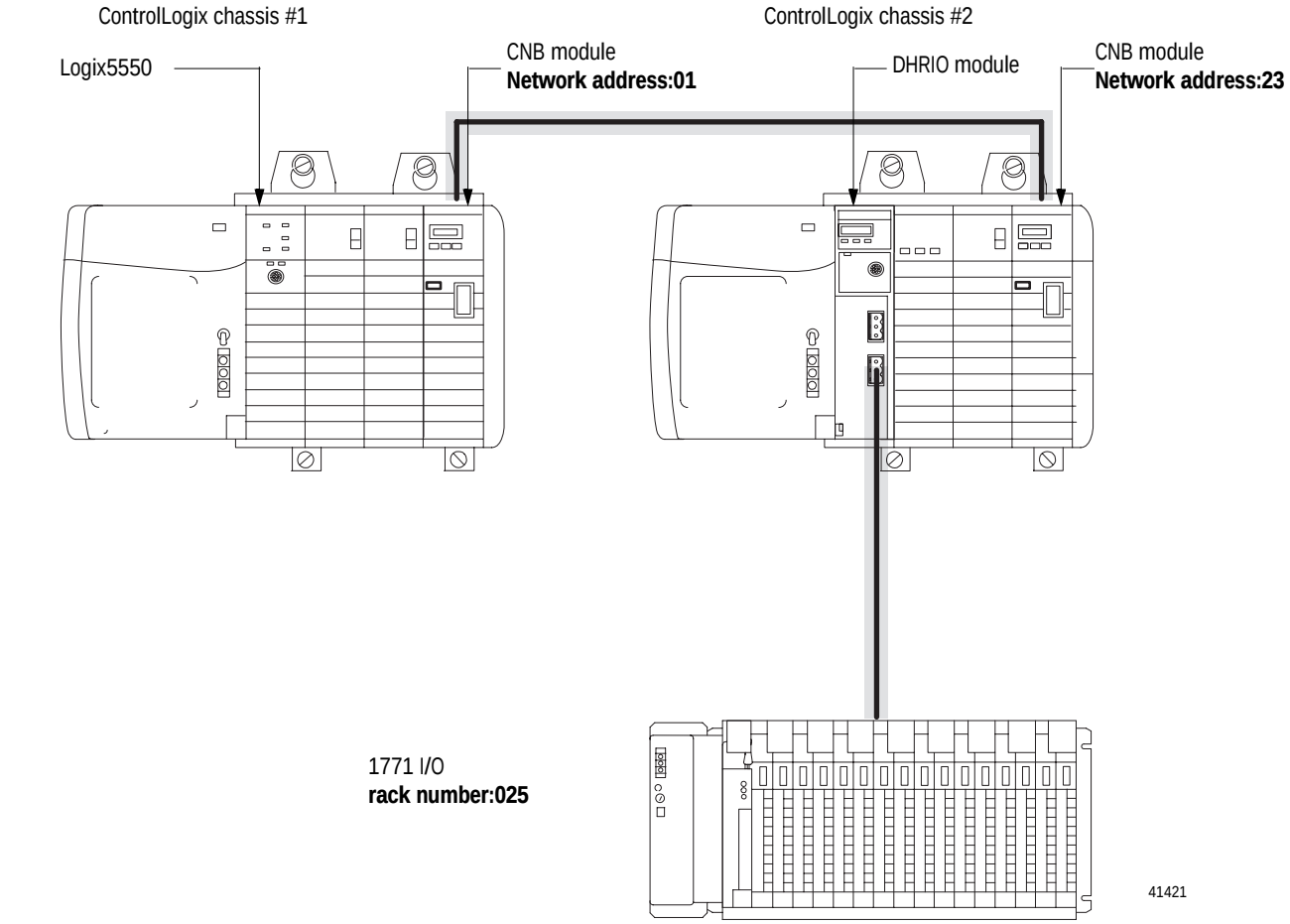
The following screen shows a sample configuration:

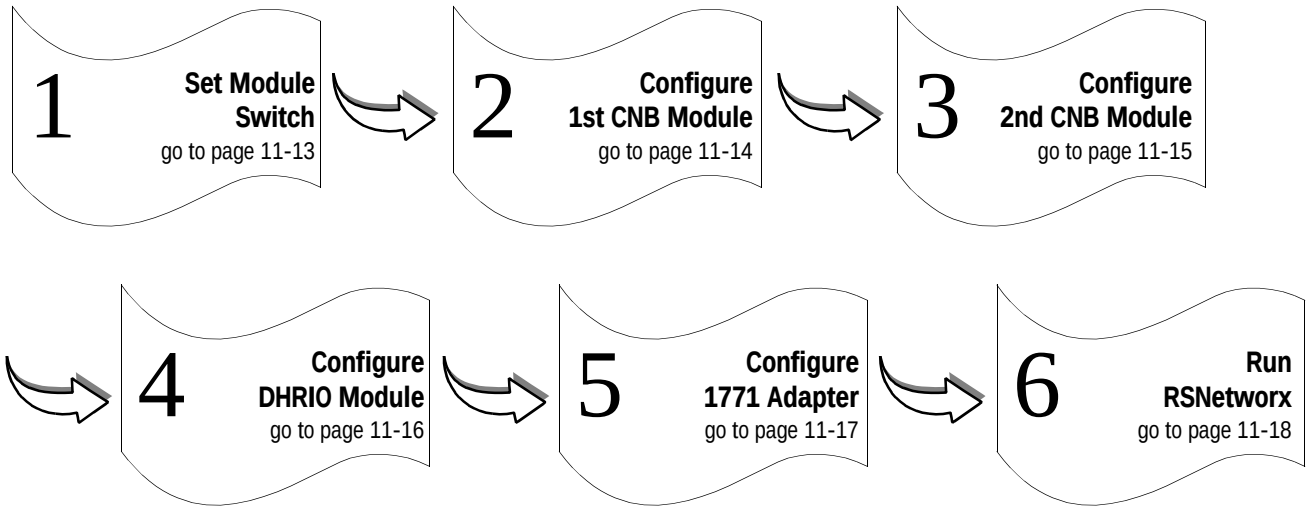


Scanning 1771 Remote I/O Adapters Through a 1756-DHRIO in a Remote Chassis

In this application, a Logix5550 scans remote FLEX I/O modules through a 1756-DHRIO module in a remote chassis over a ControlNet network.

The following diagram illustrates the steps you follow to use this application:





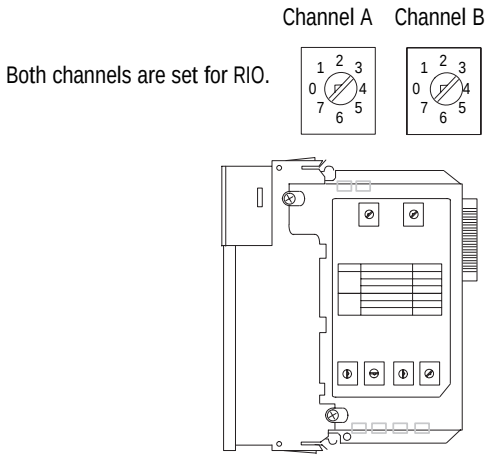
1 **Set Module Switches**

See setting switches 1-5

Set the Module Switches

In this application, channel B on the 1756-DHRIO module must be set for RIO. Channel A can be used for RIO or DH+, regardless of the usage assigned to channel B.

Set the channels as shown.



2 **Configure 1st CNB Module**

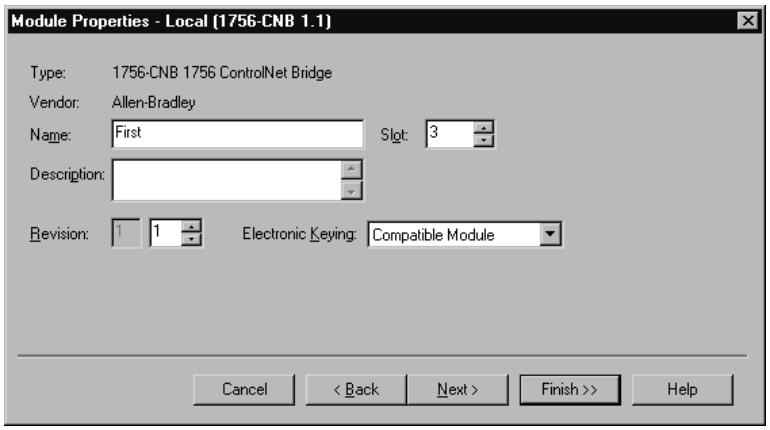
Configure 1st CNB Module

Use RSLogix5000 to configure your application. Follow these steps to configure the first 1756-CNB module:

1. Add the first 1756-CNB modules to the Controller Organizer.

For more information about how to add modules to the Controller Organizer, see the Logix5550 User Manual, publication 1756-6.5.12.

2. Configure the 1756-CNB module. The following screen shows a sample configuration:



3 Configure 2 nd CNB Module

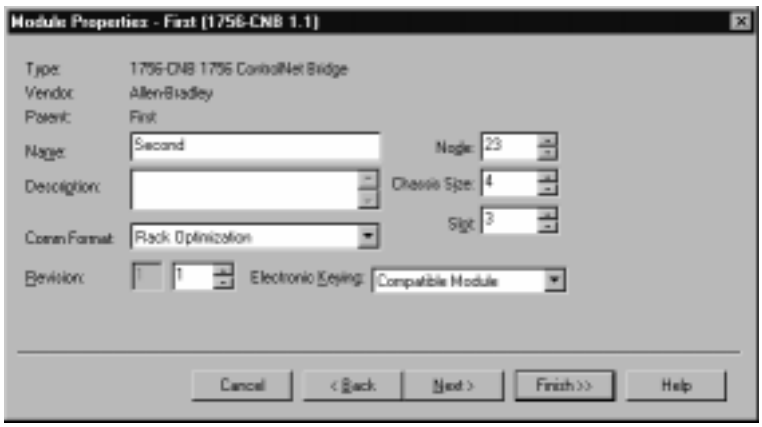
Configure 2nd CNB Module

Use RSLogix5000 to configure your application. Follow these steps to configure the first 1756-CNB module:

1. Add the second 1756-CNB modules to the Controller Organizer.

For more information about how to add modules to the Controller Organizer, see the Logix5550 User Manual, publication 1756-6.5.12.

2. Configure the 1756-CNB module. The following screen shows a sample configuration:



4 Configure DHRIO Module

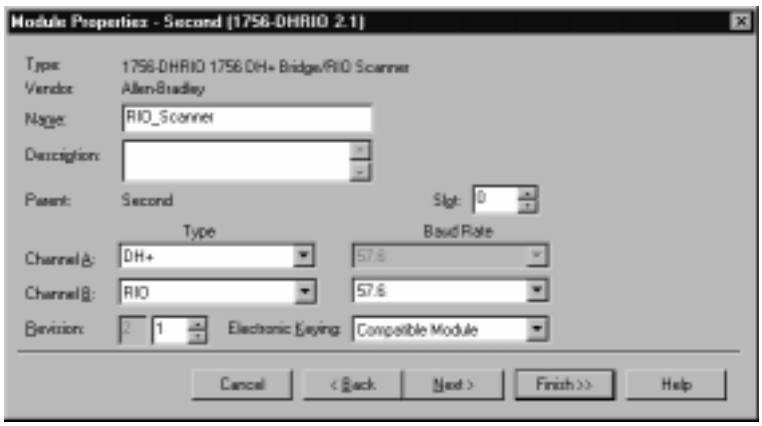
Configure DHRIO Module

Use RSLogix5000 to configure your application. Follow these steps to configure your 1756-DHRIO module:

1. Add the 1756-DHRIO module to the Controller Organizer.

For more information about how to add modules to the Controller Organizer, see the Logix5550 User Manual, publication 1756-6.5.12.

2. Configure the 1756-DHRIO module. The following screen shows a sample configuration:

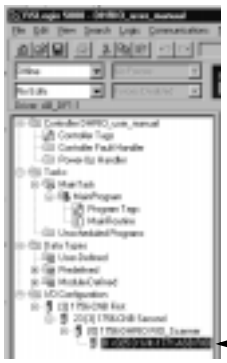


5 **Configure 1771 Adapter**

Configure 1771-ASB Adapter

Follow these steps to configure the first 1771-ASB adapter:

1. Add a 1771-ASB adapter to the 1756-DHRIO module in the Controller Organizer.

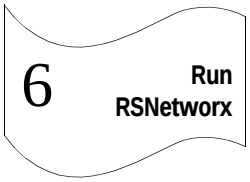


2. Configure the 1771-ASB adapter. You must fill in the following:

   - Parent channel - first screen
   - Rack # (octal) - first screen
   - Size - first screen
   - Starting group - first screen
   - Requested packet interval (RPI) - second screen

The following screens show a sample configuration:

Important: Although the Inhibit and Major Fault if Connection Fails options appear on the second screen, and can be accessed there during normal operation, they are not required fields for initial configuration.



Run RSNetworx

You must run RSNetworx for this application to begin operation. For more information on how to run RSNetworx software, see the online help for that software.

Chapter Summary and What's Next

In this chapter, you learned about connecting a Logix5550 to remote I/O.

Move on to Chapter 12 to see block-transfers applications.

Block Transfers

What This Chapter Contains

This chapter describes how to use the 1756-DHRIO module to connect a Logix5550 to a remote I/O Block Transfer (BT) module. The following table describes what this chapter contains and its location:

For information about using:	See page:
Block Transfers to Remote FLEX I/O Modules Through a 1756-DHRIO in a Local 1756-Chassis	12-2
Block Transfers to Remote 1771-ASB I/O Modules Through a 1756-DHRIO in a Remote 1756-Chassis	12-8
Chapter Summary and What's Next	12-16

This chapter contains two example BT applications. Each example explains what steps must be taken to perform these operations.

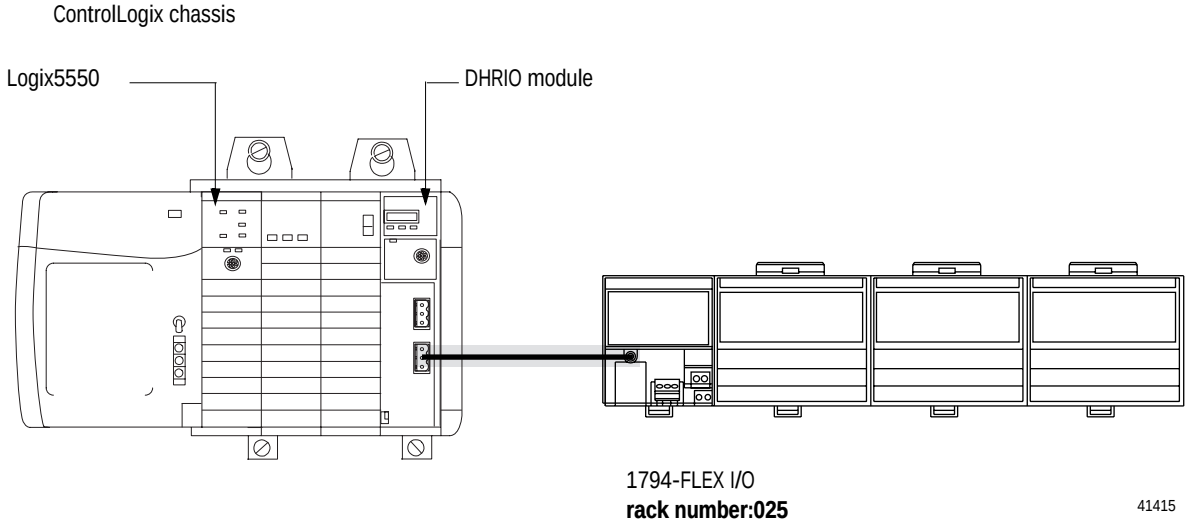
Important: In these examples, only channel B is connected to remote I/O. You can connect both channels to remote I/O simultaneously if necessary.

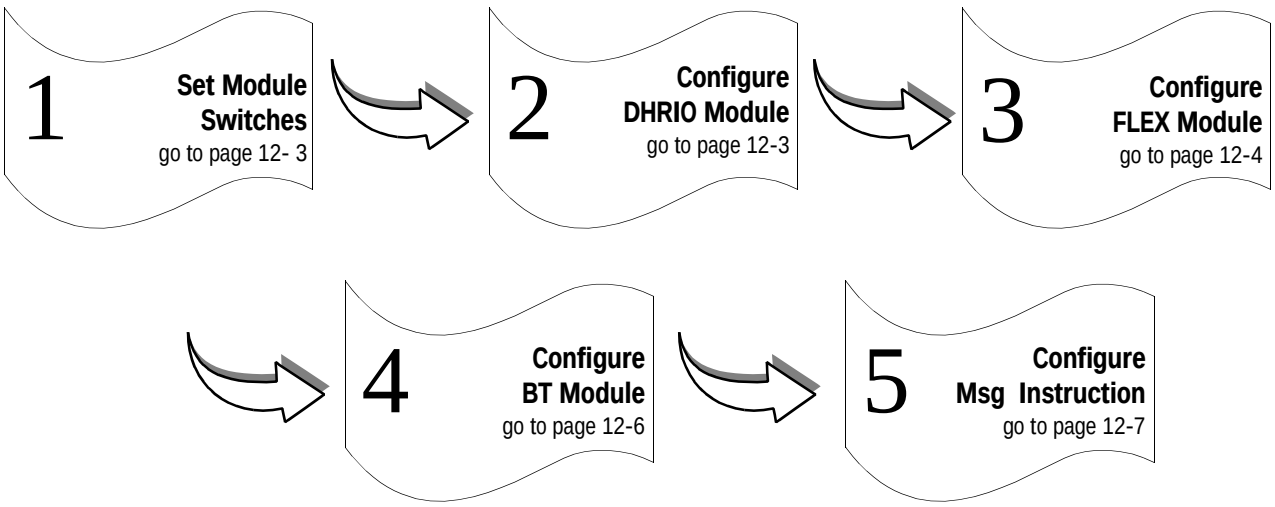
If only one channel is connected to remote I/O, it is recommended that you use channel B. If you connect channel A to remote I/O, you cannot use the programming terminal on the front of the 1756-DHRIO module.

Block Transfers to Remote FLEX I/O Modules Through a 1756-DHRIO in a Local Chassis

This application allows a Logix5550 to initiate block transfers to remote FLEX I/O modules through a 1756-DHRIO module in the local chassis.

The following diagram illustrates the steps you follow to use this application:



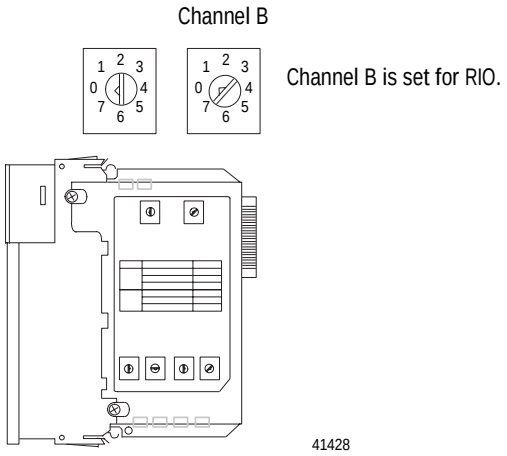


1 Set Module Switches

Set the Module Switches

In this application, channel B on the 1756-DHRIO module must be set for RIO. Channel A can be used for RIO or DH+, regardless of the usage assigned to channel B.

Set the channels as shown.



2 Configure DHRIO Module

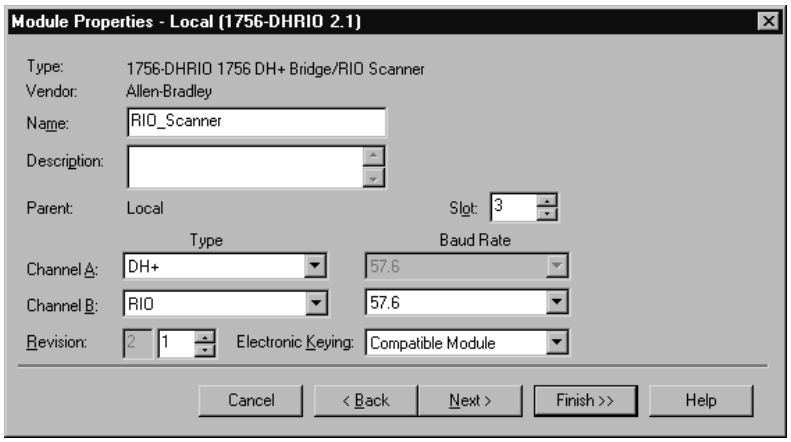
Configure DHRIO Module

Use RSLogix5000 to configure your application. Follow these steps to configure your 1756-DHRIO module:

1. Add a 1756-DHRIO module to the Controller Organizer.

For more information about how to add modules to the Controller Organizer, see the Logix5550 User Manual, publication 1756-6.5.12.

2. Configure the 1756-DHRIO module. The following screen shows a sample configuration:



3 **Configure FLEX Adapter**

Configure the FLEX Adapter

Follow these steps to configure your 1794-FLEX adapter:

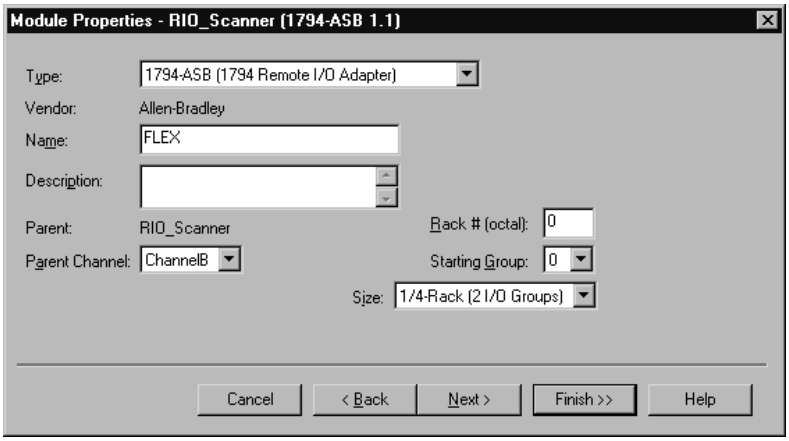
1. Add a 1794-FLEX adapter to the 1756-DHRIO module in the Controller Organizer.

2. Configure the 1794-FLEX adapter. You must fill in the following:

- **Parent channel** - select which DHRIO channel is being used to scan the FLEX I/O
- **Rack # (octal)** - represents a link to a logical rack number (in octal from 1-77), for example: 1-7, 10-17, 20-27
- **Size** - indicates how many words of data is available for the given rack, for example:
  Rack 1, size 1/4 = 2 words of input and 2 words of output
  Rack 5, size 1/2 = 4 words of input and 4 words of output
  Rack 10, size 3/4 = 6 words of input and 6 words of output
  Rack 20, size Full = 8 words of input and 8 words of output
- **Starting group** - represents the first word of input/output from a given rack and beginning at either group 0, 2, 4, or 6, for example:
  a system of 2 racks and 4 words of I/O
  Rack 12, st grp 2, size 1/4
  Rack 12, st grp 6, size 1/4

Important: When you choose a starting group, remember that there is a 1 to 1 ratio of words available and words transmitted. For example, if you configure the 1756-FLEX adapter for a 1/2 rack, you must specify a size equal to 1/2 rack.

The following screen shows a sample configuration:



You can change the configuration of a FLEX adapter after it has been entered in the Controller Organizer.

For more information on changing configuration in RSLogix 5000, see the software's online help.

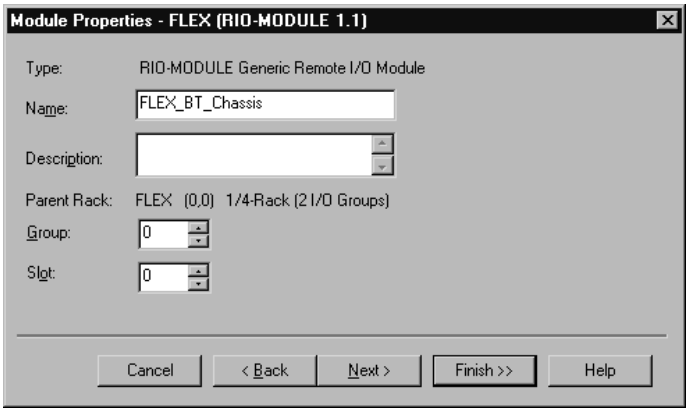
4 Configure BT Module

Configure Block Transfer Module

Follow these steps to configure your block transfer module.

1. Add a block transfer module to the 1794-FLEX module in the Controller Organizer.

2. Configure the block transfer module. The following screen shows a sample configuration when adding the module to the 1794-FLEX module:



You can change the configuration of a BT module after it has been entered in the Controller Organizer.

For more information on changing configuration in RSLogix 5000, see the software's online help.

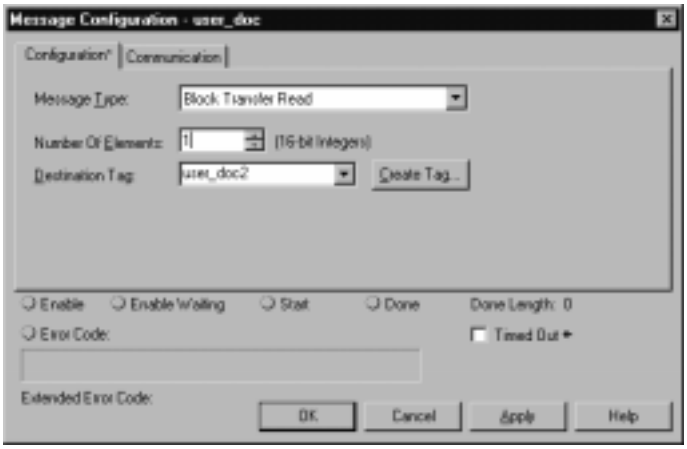
5 Configure Msg Instructions

Configure Message Instruction

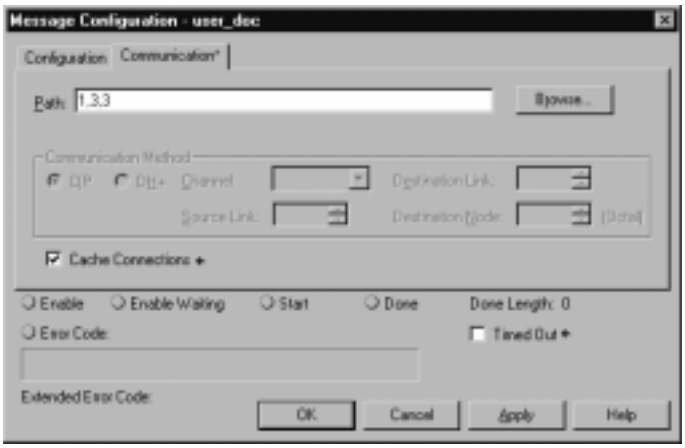
You must use RSLogix 5000 to configure the Logix5550 message instructions. Your message instructions should look like this:

Ladder rung

Configuration page

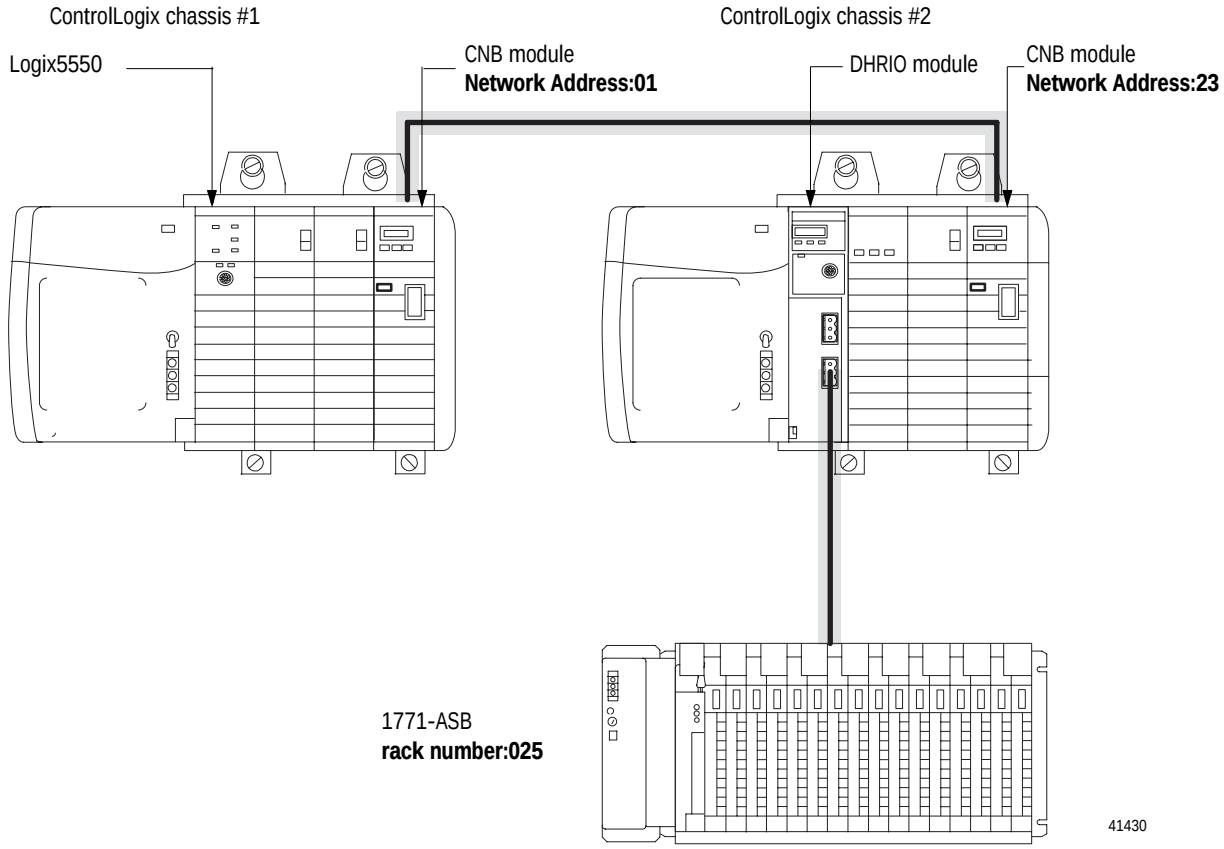


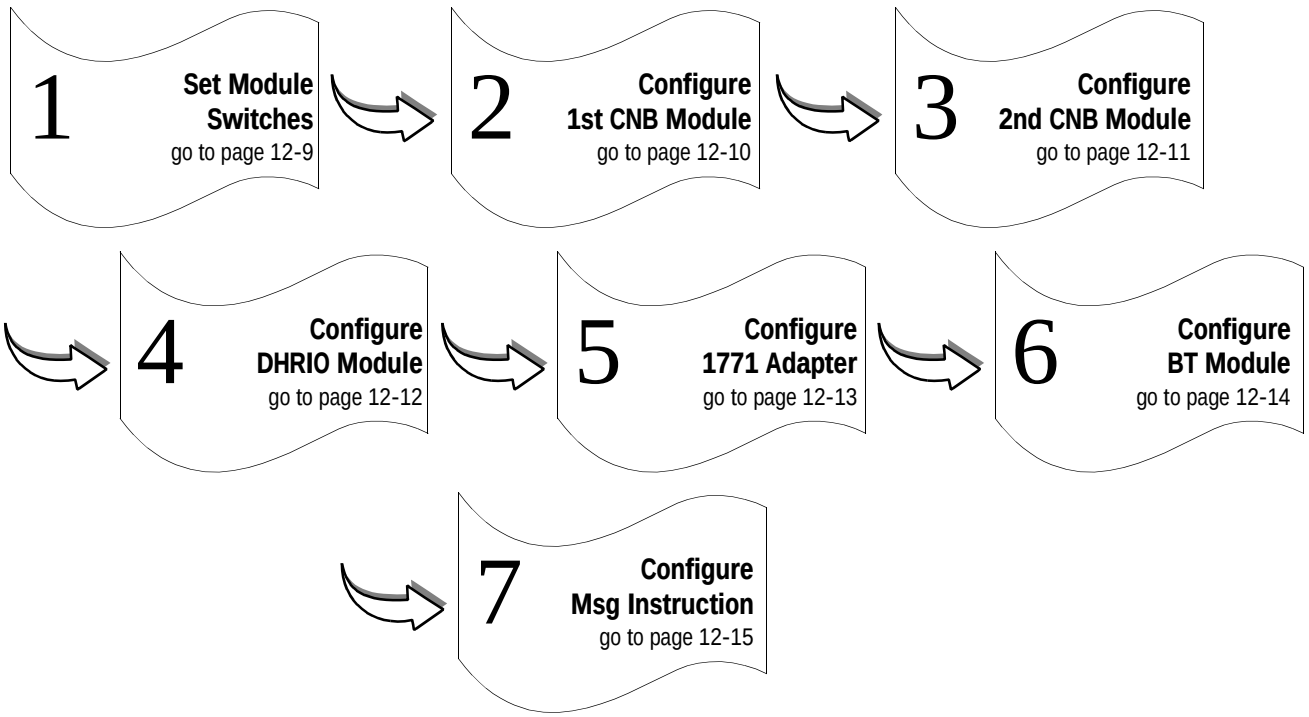
Communication page



Block Transfers to Remote 1771-ASB I/O Modules Through a 1756-DHRIO in a Remote Chassis

This application allows a Logix5550 to write block transfers to remote 1771-ASB I/O modules through a 1756-DHRIO module in a remote chassis over a ControlNet link. The following diagram illustrates the steps you follow to use this application:





Important: This example shows one 1756-DHRIO module in the local chassis. You can also connect multiple 1756-DHRIO modules in the remote chassis to additional I/O modules.

If you connect multiple 1756-DHRIO modules to remote I/O modules, follow the steps for each 1756-DHRIO module.

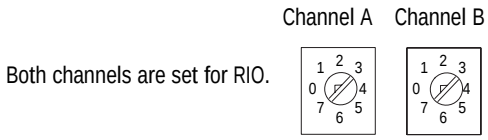
1 **Set Module Switches**

See setting switches 1-5

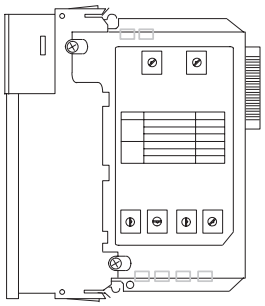
Set the Module Switches

In this application, channel B on the 1756-DHRIO module must be set for RIO. Channel A can be used for RIO or DH+, regardless of the usage assigned to channel B.

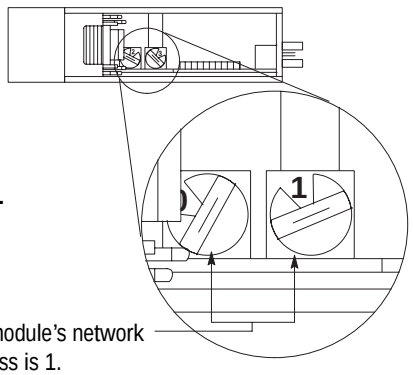
Set the channels as shown.



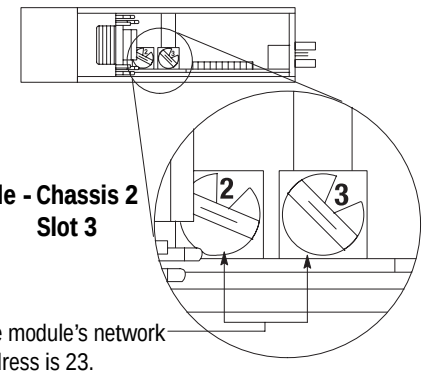
DHRIO module -Chassis 2 Slot 0



CNB module - Chassis 1 Slot 3



CNB module - Chassis 2 Slot 3



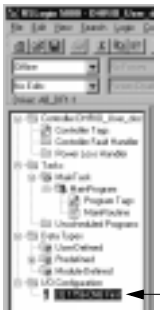
41417

2 Configure 1st CNB Module

Configure 1st CNB Module

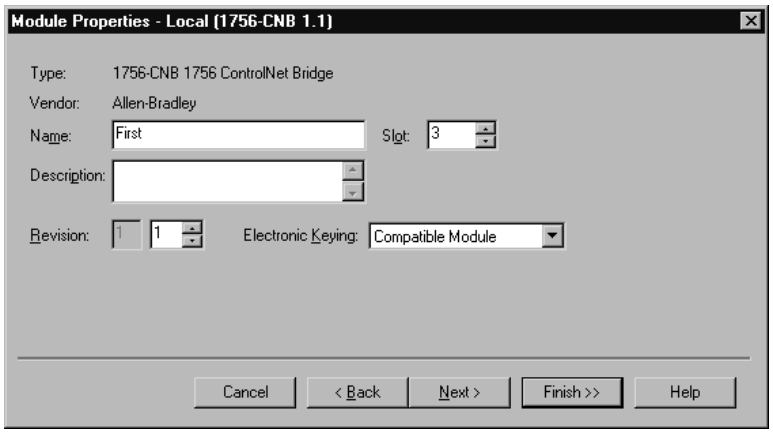
Use RSLogix5000 to configure your application. Follow these steps to configure the first 1756-CNB module:

1. Add the first 1756-CNB modules to the Controller Organizer.



For more information about how to add modules to the Controller Organizer, see the Logix5550 User Manual, publication 1756-6.5.12.

2. Configure the 1756-CNB module. The following screen shows a sample configuration when adding the module to the 1756-CNB module:



You can change the configuration of a 1756-CNB module after it has been entered in the Controller Organizer.

For more information on changing configuration in RSLogix 5000, see the software's online help.

3 Configure 2 nd CNB Module

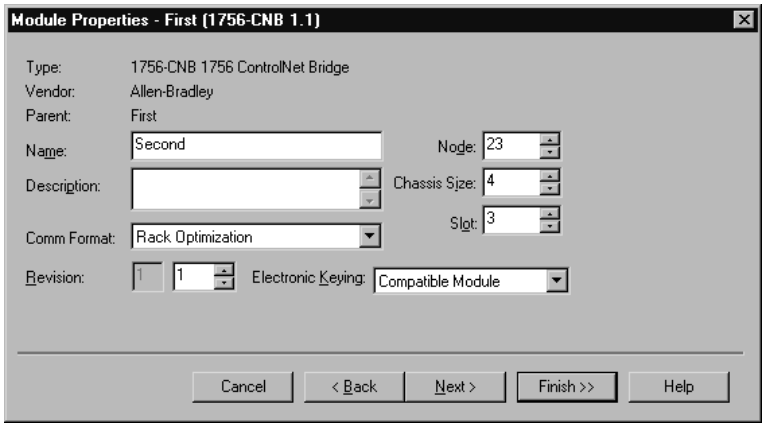
Configure 2nd CNB Module

Use RSLogix5000 to configure your application. Follow these steps to configure the first 1756-CNB module:

1. Add the second 1756-CNB modules to the Controller Organizer.

For more information about how to add modules to the Controller Organizer, see the Logix5550 User Manual, publication 1756-6.5.12.

2. Configure the 1756-CNB module. The following screen shows a sample configuration:



You can change the configuration of a 1756-CNB module after it has been entered in the Controller Organizer.

For more information on changing configuration in RSLogix 5000, see the software's online help.

4 Configure DHRIO Module

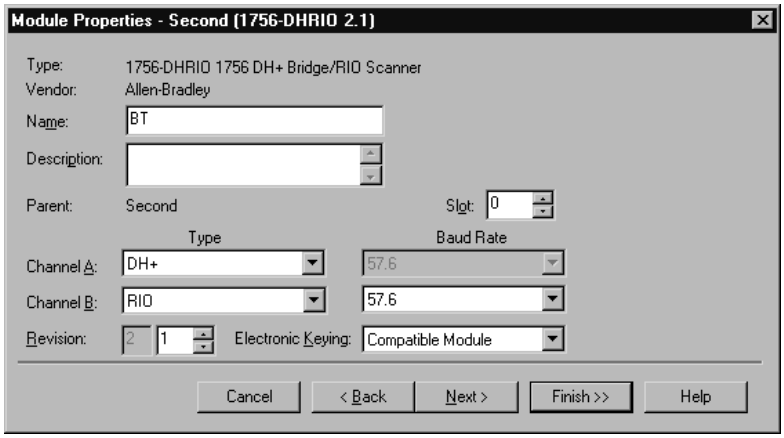
Configure DHRIO Module

Use RSLogix5000 to configure your application. Follow these steps to configure your 1756-DHRIO module:

1. Add the 1756-CNB and 1756-DHRIO modules to the Controller Organizer.

For more information about how to add modules to the Controller Organizer, see the Logix5550 User Manual, publication 1756-6.5.12.

2. Configure the 1756-DHRIO module. The following screen shows a sample configuration:



You can change the configuration of a 1756-DHRIO after it has been entered in the Controller Organizer.

For more information on changing configuration in RSLogix 5000, see the software's online help.

5 Configure 1771 Adapter

Configure 1771-ASB Adapter

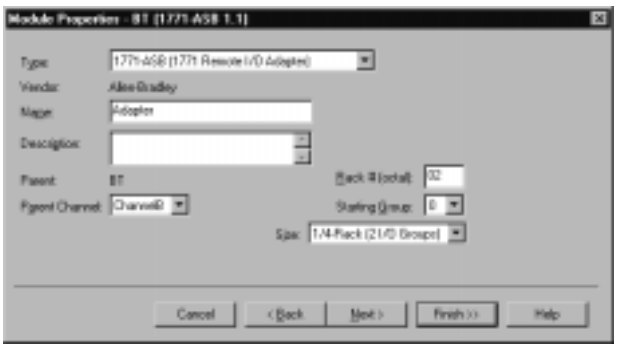
Follow these steps to configure the first 1771-ASB adapter:

1. Add a 1771-ASB adapter to the 1756-DHRIO module in the Controller Organizer.

2. Configure the 1771-ASB adapter. You must fill in the following:

   - Parent channel - first screen
   - Rack # (octal) - first screen
   - Size - first screen
   - Starting group - first screen
   - Requested packet interval (RPI) - second screen

The following screens show a sample configuration:



Important: Although the Inhibit and Major Fault if Connection Fails options appear on the second screen, and can be accessed there during normal operation, they are not required fields for initial configuration.

You can change the configuration of a 1771-ASB adapter after it has been entered in the Controller Organizer.

For more information on changing configuration in RSLogix 5000, see the software's online help.

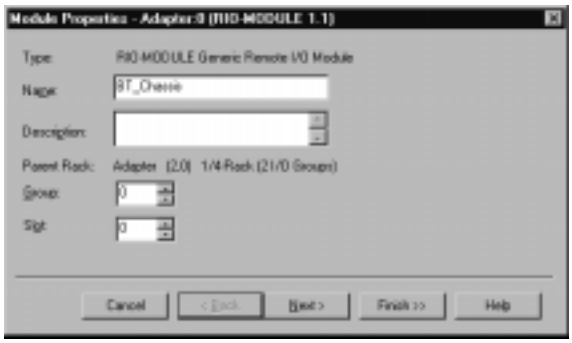
6 Configure 1771 BT Module

Configure 1771-BT Module

Follow these steps to configure the 1771-BT module.

1. Add a 1771-BT module to the 1771-ASB adapter in the Controller Organizer.

2. Configure the 1771-ASB adapter. The following screen shows a sample configuration.



You can change the configuration of a 1771-BT module after it has been entered in the Controller Organizer.

For more information on changing configuration in RSLogix 5000, see the software's online help.

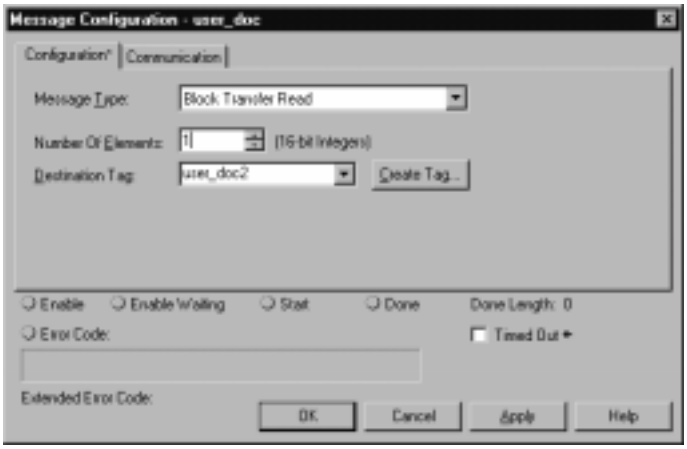
5 Configure Msg Instructions

Configure Message Instruction

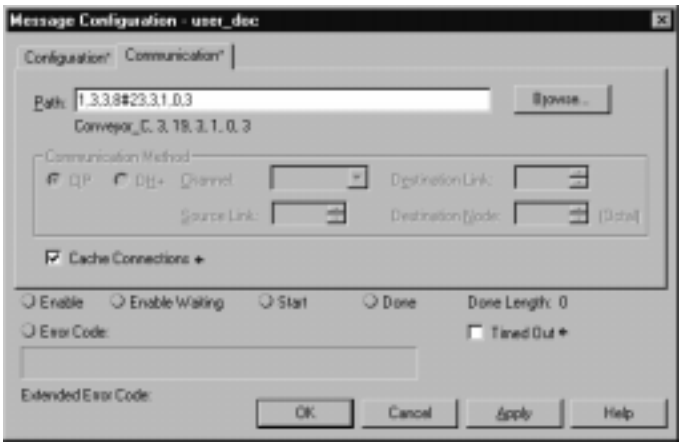
You must use RSLogix 5000 to configure the Logix5550 message instructions. Your message instructions should look like this:

Ladder rung

Configuration page



Communication page



Chapter Summary and What's Next

In this chapter, you learned about block transfer applications.

Move on to Chapter 13 to learn about troubleshooting your Data Highway Plus module.

Troubleshooting

What This Chapter Contains

This chapter describes your module's diagnositcs and methods of troubleshooting your module. The following tables describes what this chapter contains and its location:

For information about:	See page:
Checking Power Supply and Module Status	13-1
Troubleshooting the Power Supply	13-2
Troubleshooting the Module	13-2
Monitoring DH+ Communication Channels	13-5
Chapter Summary and What's Next	13-6

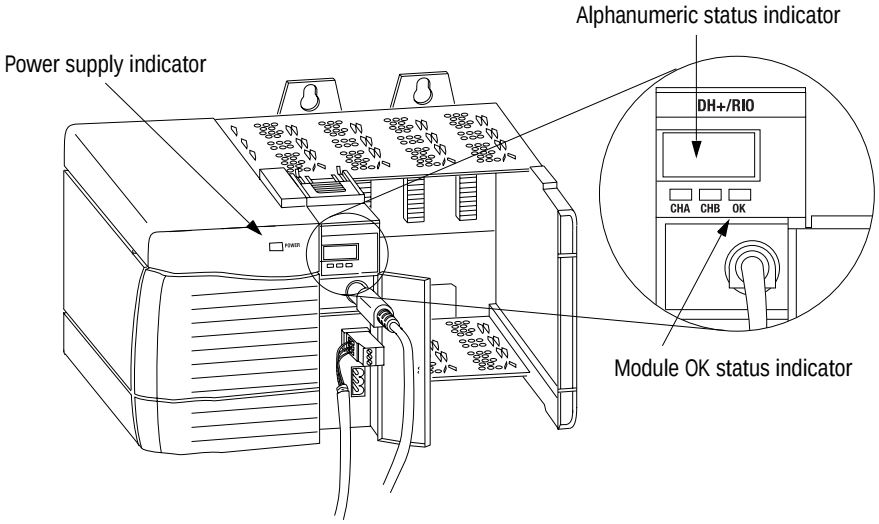
Checking Power Supply and Module Status

On power-up, three events take place simultaneously:

- Alphanumeric status indicator on the module illuminates and cycles through a sequence of messages
- Module OK status indicator shows solid red, then flashes green
- Power supply indicator shows solid green

The following table describes the sequence of messages displayed on the alphanumeric status indicator:

Sequence of display:	Where:
For DH+ applications	
A DH	A is channel (A or B) and DH indicates network type is DH+
A#XX	XX is the channel's node address
XXXX	XXXX is the channel's status message
For RIO applications	
B IO	B is the channel (A or B) and IO indicates network type is remote IO
SCAN	SCAN indicates scanner
XXXX	XXXX is the channel's status message



Troubleshooting the Power Supply

Use the following table to troubleshoot the power supply:

If the POWER indicator is:	The power supply is:	Take this action:
Off	Not operating	Turn power switch ON Check power wiring connections Check fuse
On	Operating	None, normal operation

Troubleshooting the Module

Use the alphanumeric indicator status message and the module status OK indicator to troubleshoot your 1756-DHRIO module.

The following table describes the messages that may appear on your module's alphanumeric indicator status message:

If the indicator is:	The network status is:	Take this action:
For all applications:		
FLSH	Checksum in memory did not match	Record the display Remove and reinsert or power down the module
SRAM	Bad RAM memory	Record the display Remove and reinsert or power down the module
TERM	Backplane termination resistor problem	Record the display Remove and reinsert or power down the module
BPIC	Backplane ASIC detected error	Record the display Remove and reinsert or power down the module
ASIC	Backplane ASIC detected error	Record the display Remove and reinsert or power down the module
VRTX	Operting system error	Record the display Remove and reinsert or power down the module
STOP	Module is in redundant system	Remove the module 1756-DHRIO module does not support redundancy
XMIT FALT	Transmitter Underrun	Record the display Remove and reinsert or power down the module
NO MEM	Unrecoverable Out of Memory	Record the display Remove and reinsert or power down the module
FPWR	DC power failure detected	Record the display Remove and reinsert or power down the module
WTDG	Internal watchdog triggered	Record the display Remove and reinsert or power down the module

If the indicator is:	The network status is:	Take this action:
BOOT	Module is running Boot code	Normal when updating module firmware If not updating firmware or after updating firmwarre: Record the display Remove and reinsert or power down the module
BERR, FAIL, ADDR, ILLI, DVDZ, CHKI, TRPV, PRIV, TRAC, EM10, EM11, EUNS, EUSR, EERR, SPUR, UNIN	Fatal internal error	Record the display Remove and reinsert or power down the module
Four digits that are frozen	Fatal internal error	Record the code Remove and reinsert or power down the module
For DH+ applications		
OFF LINE	Data Highway Plus is in STOP state	Correct configuration
DUPL NODE	Duplicate node address	Choose another node address and reset switches
ONLY NODE	Only node on Data Highway Plus link	Check cables
CNFG FALT	Incorrect routing table configuration Incorrect DH+ channel configuration	Verify the module is inserted into the correct slot and chassis Verify the routing table and DH+ channel configuration, then Apply (or Default, if appropriate) routing table and DH+ channel configuration
OK	Normal operation for that channel	None, normal operation
For RIO applications		
MUTE LINK	No adapters found on remote I/O	Add an adapter to the remote I/O network
RACK OVER	Rack overlap on remote I/O	Reconfigure remote I/O racks
DUPL SCAN	Duplicate scanner on remote I/O	Check remote I/O scanner configuration
MAX_ DEV_	Maximum devices exceeded on remote I/O	Remove devices to meet limitations on remote I/O network
CHAT LINK	Babble detected on remote I/O	Check remote I/O device and network connections
OK	Normal operation for that channel	None

The following table describes the messages that may appear on your module's status OK indicator:

If the OK indicator is:	The module status is:	Take this action:
Off	Not operating	Apply chassis power Verify module is completely inserted into chassis and backplane
Green flashing	Operating but not routing messages	None, if no messages are actively being routed through the module To route messages, use module default configuration or configure module
Red, then Off	Performing self-test	None, normal operation
Green	Operating and routing messages	Verify module configuration
Red	In major fault	Reboot module if red reoccurs, replace module
Red flashing	In major fault or configuration fault	Check alphanumeric indicator and take action described in alphanumeric indicator status message table.

The following table describes the messages that may appear on your module's channel status indicators for channel A or channel B:

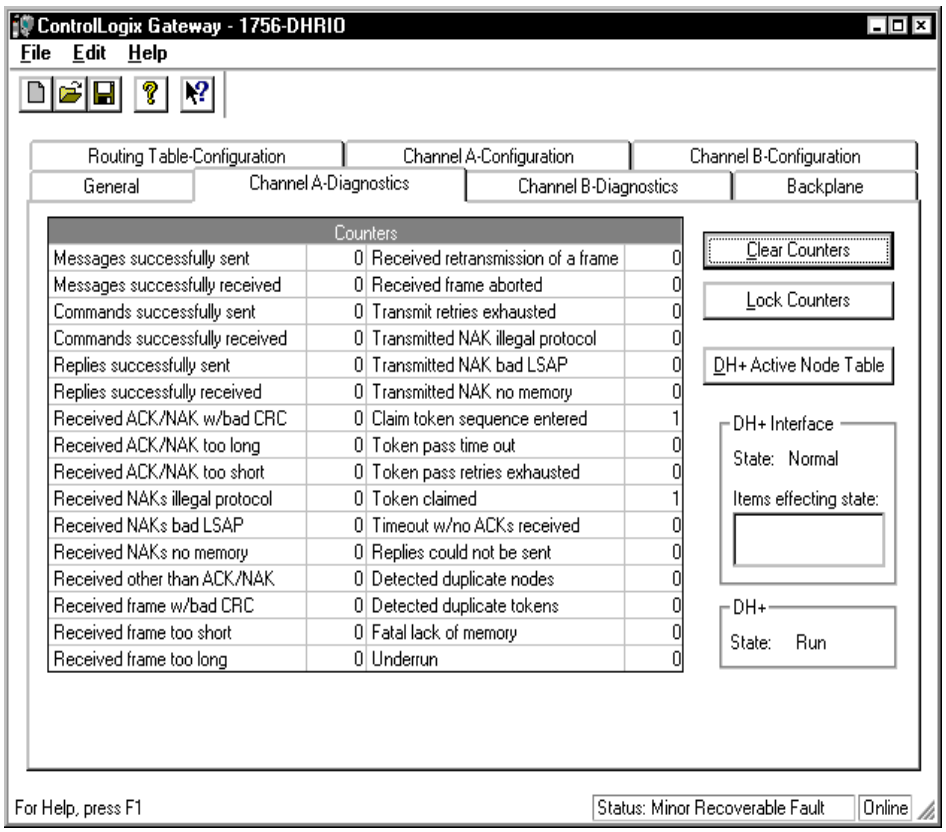
If the OK indicator is:	The channel status is:	Take this action:
Off	Not online	Place channel online
Green	Operating	None, normal operation
Green flashing	One or more nodes faulted or failed No other node on the network	Check power at other chassis Check cables
Red	Hardware fault	Reboot module If red reoccurs, replace the module
Red flashing	Duplicate node detected	Check node address

Monitoring DH+ Communication Channels

You can use the ControlLogix Gateway Configuration software (1756-GTWY) to monitor the status of a 1756-DHRIO module.

1. Start the configuration software and select the 1756-DHRIO module.
2. Select a **Port Diagnostics** tab.

Diagnostic data is stored in the 1756-DHRIO module. These counters can be reset in the 1756-DHRIO module. You see a list of counter values similar to the one below:



Chapter Summary and What's Next

In this chapter, you learned about troubleshooting your 1756-DHRIO module.

Move to Appendix A to learn about PCCC commands supported by the 1756-DHRIO module.

PCCC Commands Supported by the Data Highway Plus Module

What This Appendix Contains

This appendix describes PCCC commands that your module will execute.

Echo

Any data sent in the echo command is returned in the echo reply.

CMD=06h, FNC=00

ID Host and Status

This command allows you to check the location and status of the controlling intelligent device, such as a PLC-5, that is connected to the DHRIO network.

CMD=06h, FNC=03

Read DH+ Diagnostic Counters

Diagnostic counters are bytes of information stored in RAM in you 1756-DHRIO module. The counters occupy a block of the module's internal scratch RAM. Your module's counters wrap around to zero when they overflow.

Counters are used to record events that can be used in debugging and long-term reliability analysis. You must issue a **diagnostic read** to check the information in your module's counters.

CMD=06h, FNC=01

Reset DH+ Diagnostic Counters

After reading your 1756-DHRIO module's diagnostic counters, you may want to reset them back to zero to clear that block of your module's internal scratch RAM.

CMD=06h, FNC=07

Specifications

Description:		Value
Module Location		ControlLogix chassis
Maximum Backplane Current Load		850mA @ +5.1V dc and 1.7mA @ 24 V dc from I/O chassis backplane
Power Dissipation		4.5W maximum
Thermal Dissipation		15.4 BTU/hr maximum
Environmental Conditions:		
	Operational Temperature	0-60°C (32-140°F)
	Storage Temperature	–40 to 85°C (–40 to 185°F)
	Relative Humidity	5-95% without condensation
Shock Unpackaged		30g operational 50g non-operational
Vibration Unpackaged		2g from 10-150Hz
Connections		32 CIP connections available/DH+ channel
Conductors	Wiring Category	Belden 9463 twinaxial 2[1]
Agency Certification (when product or packaging is marked)		Class I Div 2 Hazardous[2] Class I Div 2 Hazardous[2] marked for all applicable directives

1 Use this conductor category information for planning conductor routing as described in system level installation manual. Also refer to 1770-4.1, "Programmable Controller Wiring and Grounding Guidelines."

2 CSA certification–Class I, Division 2, Group A, B, C, D or nonhazardous locations
FM approved–Class I, Division 2, Group A, B, C, D or nonhazardous locations

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